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DRAFT
New Jersey Comprehensive Wildlife Conservation Strategy
for Wildlife of Greatest Conservation Need

Prepared by the
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Division of Fish and Wildlife
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Preface

Accompanying this introductory letter is a remarkable document – the New Jersey Comprehensive Wildlife Conservation Strategy (CWCS), a far-reaching blueprint for the protection and management of the wildlife species in our state that are most in need of conservation.

Every state was/is required to develop such a strategy that focuses on species of greatest conservation need during 2005 in order to qualify for federal funds through the State Wildlife Grants program. While the strategy focuses on special need species and describes the conservation work that will benefit those species, ultimately all fish and wildlife species in New Jersey will benefit from this work. An array of partners, including other government agencies, conservation groups, private landowners and other members of the public, helped develop the New Jersey CWCS. It lays the foundation for better coordination of wildlife research and management among programs within the New Jersey Division of Fish and Wildlife, state and federal agencies and many partners in the conservation community.

As you review it, I believe you will agree with me that the strategy goes far beyond a basic outline. The CWCS lays out the formidable challenges that today confront these important species in New Jersey and all those who care about them. In the most densely populated state in the nation, such challenges are inevitable.

Yet, as the CWCS makes clear, particularly for a state its size, New Jersey is blessed with an incredible variety of natural resources and amazingly diverse ecosystems and wildlife communities. To protect them, the Department of Environmental Protection, our Division of Fish and Wildlife and the division’s cutting-edge Endangered and Nongame Species Program (ENSP) cannot do the job alone. Fortunately, as the strategy also makes clear, we are blessed with a cornucopia of enthusiastic, dedicated partners and collaborators.

Indeed, for me the most noteworthy aspect of the strategy isn’t just that, for the first time ever, it provides a comprehensive road map of what needs to be done for particular species, groups of species or particular habitats. It’s that it identifies which people, agencies or organizations, whether inside or outside of state government – are best suited to execute each strategy. Not surprisingly, given the fact that this document itself is the product of extensive collaboration, in most cases the strategy calls for multiple collaborators to get involved – including the public.

Underpinning the strategy are seven core principles. These are:

1. Addressing Habitat Destruction

Habitat destruction, the greatest threat to New Jersey wildlife, is analogous to the “taking” or killing of wildlife since it denies organisms the capacities crucial to existence, such as the ability to successfully feed and/or reproduce. New Jersey is currently moving towards adopting endangered and threatened species rules paralleling federal rules that protect both rare wildlife and their associated habitats.

2. Advancing Stewardship and Restoration

Another key focus of the CWCS is managing lands for biodiversity. To this purpose, the CWCS seeks dedicated funding for biodiversity land management on both public and private lands and solicits statewide application of *best management practices* to improve or maintain the ecological integrity of NJ's natural communities.

3. Continuing Sound, Science-based Wildlife Management

In order to control overabundant species where they occur, such as white-tailed deer, the CWCS suggests a statewide, multi-organization effort to increase public education and awareness of the benefits that hunting of certain species has for all wildlife and natural communities.

4. Developing Government-wide Invasive Species Policy

Invasive species, both plant and animal, greatly threaten natural biodiversity and often out-compete and crowd out native species in the absence of natural controls. The CWCS calls for concerted efforts to control invasive species and for the implementation of bioremediation plans to restore natural biodiversity to the New Jersey environment.

5. Implementing Recovery Plans for All Imperiled Species

In our role as good stewards of the land and flora and fauna that inhabit it, recovery plans for all endangered, threatened, and other rare species must be devised and implemented.

6. Continual Updates of Scientific Data and Geographic Information

Up-to-date scientific data and geographic information is the foundation of the CWCS. To guide the strategy as it evolves through regular reviews and updates, we will rely upon habitat mapping, species surveys, and scientific modeling to determine the most critical habitats and wildlife in greatest conservation need.

7. Confronting Challenges in Urban Environments

As the nation's most densely populated state, New Jersey's urban environment presents unique challenges to the conservation and management of rare wildlife. The CWCS addresses issues such as managing rare species that have become adapted to urban environments, identifying oases of urban wildlife habitat, restoring natural resources within urban environments, and minimizing impacts of contaminants and toxins to wildlife.

The CWCS divides the state into five distinct physiographic landscape regions, and then further subdivides each of those regions into distinct zones delineated by watersheds and other geographic features. Once you locate the particular zone where you live or in which you are interested, you can read about:

- Key habitat features
- The wildlife of greatest conservation need found in those habitats
- Threats to this wildlife and the habitats upon which they depend
- Habitats
- Conservation goals

- Conservation actions needed to achieve those goals
- Partners best suited to help achieve those goals
- How progress toward these goals will be monitored

New Jersey faces unprecedented wildlife conservation challenges to address habitat disturbances and destruction caused by widespread development, human activities, recreational vehicles, contaminants, invasive and overabundant species. Fortunately, we have dedicated partners working with us to protect our resources including non-profit conservation groups and hunter and angler organizations among them. Moreover, we have worked diligently during the past 30 years to identify critical fish and wildlife species and habitats that have special conservation needs and to develop effective strategies to restore and conserve all of our fish and wildlife species.

Our Comprehensive Wildlife Conservation Strategy ties together much of our wildlife data and management strategies so we can provide a brighter future for New Jersey's rare species and important habitats. It also offers New Jersey residents many new opportunities to play a role in wildlife conservation by volunteering to help biologists on research and management projects, through the use of habitat management applications on private lands and by supporting conservation actions and organizations that are key to this strategy's success. I invite everyone to review the Comprehensive Wildlife Conservation Strategy and become involved in conserving New Jersey's wildlife in any way that you can.

Bradley M. Campbell
Commissioner
NJ Department of Environmental Protection

I. Overview

A. The Unprecedented Challenge Facing Wildlife Conservation in New Jersey

The rapidly changing landscape of New Jersey creates an unprecedented wildlife conservation challenge for its citizens. Destructive influences on habitat and wildlife populations abound in our state. Some of these influences result from the combined negative pressures of those normally associated with urban states, such as unsustainable development and the inevitable damaging impacts to all wildlife from habitat destruction. Other influences more associated with rural states, include human competition with wildlife for natural resources, declining forest health and the influx of exotic or invasive species..

Since New Jersey has extremely diverse and ecologically significant natural communities, the combined negative impacts of these influences are enhanced. Our larger, unfragmented forest tracts are among the largest on the mid-Atlantic coast and are home to resident bobcats, barred owls, and timber rattlesnakes and provide essential stopover habitat for most of the eastern U.S. migratory population of songbirds and raptors. Similarly, New Jersey's Atlantic and Delaware Bay coastal habitats are home to bald eagles, northern harriers, black rails, and piping plovers and are critical to millions of migratory raptors, waterfowl, shorebirds, butterflies, dragonflies, and fishes. Our woods, wetlands, streams, and fields support a staggering array of wildlife species, including 73 state endangered and threatened species, some of which are recognized as globally rare.

Extraordinary threats in an extraordinary natural landscape present a great challenge to New Jersey residents. Undaunted, our citizens have overwhelmingly supported important initiatives to protect our wildlife and habitat. New Jersey is the first state where every county has a voter-approved land acquisition program. The state itself spends millions of dollars for important land acquisition, more than any other state in our region. New Jersey's public land system is impressive. In fact, we have more land in public ownership than most states, including many that are much larger than New Jersey. In addition, the NJ Department of Environmental Protection's Land Use Regulation Program annually protects thousands of acres from unwise development because we have one of the few statewide programs that protects wetlands, vernal pools, and important coastal habitats.

These significant tools exist to protect and manage all wildlife. But if we ask whether all of our wildlife species are secure and if they all will be available to our children or to their children, the answer is not likely. The number of species identified as being threatened with extinction in New Jersey grows every year; 14 new species have been listed since 2001. Although we are rapidly buying land to protect throughout New Jersey, these acquisitions do not come close to equalling the amount of land being lost to development. In fact, each year New Jersey loses nearly 4,000 hectares of farmland alone to development. Clearly we need new tools and new methods to address this challenge.

The New Jersey Comprehensive Wildlife Conservation Strategy for Species of Greatest Conservation Need (CWCS) is just such a tool. Originally created to meet the eligibility requirement for US Fish and Wildlife Service State Wildlife Grants, New Jersey's CWCS has evolved into something much more important. Under the leadership of the Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP) and with the help of staff of the other Division Bureaus, partner conservation agencies and stakeholder groups, this document is clearly becoming a blueprint for statewide protection of wildlife with special conservation needs. The CWCS embodies the collective judgment of the state's conservation professionals regarding which species should receive special attention and what should be done. It identifies tasks for nearly every agency and group that has some influence over land and wildlife. We intend to use the CWCS to create a more robust system of rare wildlife and habitat protection that utilizes all appropriate agencies and groups. Once complete, the CWCS will provide a dynamic tool for landowners of all types, from backyard owners to land stewards of large public forests, to use for the protection of habitat and species of greatest conservation need.

Managing For Biodiversity:

One major premise and seven focus areas underlie the CWCS. The major premise is that certain species require new or additional protection and management. The seven focus areas are:

1. Habitat Destruction

Habitat destruction is the greatest threat to New Jersey wildlife. It is the equivalent of actually "taking" or killing wildlife, since an organism denied its ability to feed and/or reproduce can no longer exist. New Jersey is moving to adopt endangered and threatened species rules to further protect endangered and threatened wildlife and their associated habitat. Identification, protection, and, where possible, acquisition of critical habitats for such wildlife are key components of the CWCS. Another goal is to further integrate water quality regulations and aquatic habitat delineation into endangered and threatened wildlife protection.

2. Stewardship and Restoration

Managing lands for biodiversity is another key thrust of the CWCS. To this purpose, the CWCS recognizes the need for dedicated funding for biodiversity land management on both public and private lands. NJ has recently initiated coordinated biodiversity protection on DEP lands. Applying *best management practices* focused on endangered, threatened, and rare species and maintenance or improvement of the ecological integrity of New Jersey's natural communities will be the standard operating procedure on all public lands. Conservation actions throughout the document that address this issue include, but are not limited to, the development of *best management practices*, maintaining and enhancing recognized tracts of critical habitats for suites of wildlife species, and the maintenance and restoration of riparian buffers.

3. Wildlife Management

Control of overabundant species in identified areas, such as white-tailed deer, is an essential component of the CWCS. It calls for a statewide, multi-organization effort to increase public education and awareness of the benefits that hunting of certain species has for all wildlife and natural communities. The CWCS calls for the development of area-specific deer densities with goals focused on forest health and ecological integrity, innovative methods to increase land accessibility to hunters, and long-term monitoring of habitat health.

4. Government-Wide Invasive Species Policy

Invasive species, both plant and animal, greatly threaten natural biodiversity. Without natural controls, they often out-compete and crowd out native species leaving a less diverse ecosystem. The State's Invasive Species Council has worked to address the threats of invasive species in New Jersey and regionally. The CWCS and Council calls for concerted efforts for both the control of invasive species and bioremediation plans to restore natural biodiversity to the New Jersey environment. Conservation actions such as identifying routes of exposure and introduction of invasive species, improving intra- and interstate monitoring efforts, and prioritizing management and eradication efforts are the basis of restoring New Jersey's natural communities to their native state.

5. Recovery Plans for All Species

In our role as good stewards of the land and flora and fauna that inhabit it, recovery plans for all endangered, threatened, and other rare species must be devised and implemented.

6. Data and Scientific Updates

The foundation of the CWCS is sound science. To guide the strategy as it evolves, we will rely upon habitat mapping, species surveys, and scientific modeling to determine the most critical habitats and wildlife in greatest conservation need. Regular monitoring to measure progress and refine approaches is also critical to the strategy's success. The CWCS calls for ongoing research of rare wildlife, regular updates of the ENSP's Landscape Map used for regulatory and planning purposes, and the completion of accompanying riparian mapping. In addition, the CWCS is considered a dynamic document to be formally reviewed every five years.

7. Challenges in Urban and Suburban Environments

As the nation's most densely populated state, our urban and suburban environment presents unique challenges. Among them – how to manage individuals and pairs of endangered and/or threatened species, such as bald eagles and peregrine falcons, that nest or somehow otherwise adapt to and utilize these environments. The CWCS also calls for a concerted effort to identify oases of urban wildlife habitat and, where appropriate, to restore natural resources within urban environments. Other goals include identifying and minimizing toxins found in New Jersey's biota (plant and animal life) and to identify and minimize catastrophic risks to wildlife, such as oil spills.

Our Strategy Builds on Four Existing Strengths of the Division of Fish and Wildlife's Endangered Species Program (ENSP)

During the recent history of the ENSP, our staff has devoted significant efforts to four programs that are at the heart of the USFWS requirements for the CWCS. While they are more fully described later, they are:

1. The Landscape Project

The Landscape Project is a proactive, ecosystem-level, geographic information systems (GIS) approach to identifying and delineating areas critical for imperiled and special concern animal species within New Jersey. The Division of Fish and Wildlife's (DFW) ENSP began the project in 1994 with the goal of protecting New Jersey's biological diversity by maintaining and

enhancing imperiled wildlife populations within healthy, functioning ecosystems. To create the maps, an extensive database of imperiled and priority species location information is combined with the New Jersey Department of Environmental Protection's (NJDEP) land-use/land-cover data. Critical area maps are available to the public for download in ArcView Shape file format and through the DEP's iMAP Internet function.

2. Delphi Status Review

Wildlife species are generally assigned a legal status (e.g., endangered, threatened, stable) by state wildlife agencies. That status confers legal protection or management priority within the state. Most states rely on subjective determinations made by a group of experts. We adapted the Delphi Status Review (or Delphi process) to achieve greater objectivity in determining the relative endangerment or stability of a species' population. A systematic method for reaching consensus among experts, the Delphi Status Review is an iterative process characterized by anonymity among the participating experts and controlled feedback via the principal investigator. The results of this status assessment are used to assign the legal status of species in the state. Thus far, birds, reptiles, amphibians, freshwater mussels, butterflies, moths, dragonflies, and damselflies have gone through Delphi Status Review.

3. State Wildlife Grants Work Plan (SWG)

State Wildlife Grants, established in the fall of 2001, is a federal grant program aimed at preventing wildlife of greatest conservation need from declining to the point of becoming threatened or endangered. The United States Fish and Wildlife Service (USFWS) provides funds to state fish and wildlife agencies for research and planning on these species. In preparation for annual submittals, the ENSP developed a comprehensive work plan identifying both the necessary research, survey and management projects necessary to protect wildlife of greatest conservation need and the partnerships necessary to deliver those actions. This work plan was reviewed by the ENSP's Advisory Committee (ENSAC), which includes representatives of most of the state's non-governmental conservation agencies. The efforts outlined within the work plan have been incorporated into the New Jersey CWCS.

4. Endangered and Nongame Advisory Committee (ENSAC)

The ENSAC was established in 1973 under the implementation of the state Endangered Species Act (ESA). The composition of the committee, academic (four seats), conservation group leaders (three seats), public (three seats) and veterinary profession (one seat) was originally set by the ESA and aimed to provide an effective review of the actions and plans of the Endangered and Nongame Species Program (ENSP). The committee also reviews all recommendations of the ENSP to change the status of species. As the meetings are open to the public, the ENSAC provides a regular public review of ENSP actions, plans and recommendations and has been very helpful in identifying the strengths and weaknesses of our work. The ENSAC has reviewed the SWG work plan, Delphi Status Review recommendations and the Landscape Project, and now the iterations of the CWCS.

The first draft of the New Jersey CWCS has been reviewed by the state's most respected conservation professionals and therefore represents a consensus on the species of greatest conservation need and the actions necessary to protect them.

The first draft was presented to each of the regional ENSP biologists who were asked to create a more specific strategy for each of five landscapes in the state (Figures 1 and 3). These include the Delaware Bay, the Atlantic Coast, the Pinelands, the Piedmont Coastal Plain, and the Highlands and Ridge and Valley, which collectively are known as the Skylands Region. Conservation Zones, smaller areas within each Landscape, were established using watershed boundaries and geographical landscape features determined by ENSP biologists. Threats and goals were then developed along with actions necessary to protect or recover species from threats from three perspectives: statewide; within each of the five landscapes; and within each of the Conservation Zones. Based on these three perspectives, many iterative reviews by our staff yielded the first draft, which was presented for internal and external peer review.

This phase of the review process initiated with other bureaus within the Division of Fish and Wildlife. After incorporating suggestions from the Bureaus of Freshwater Fisheries, Wildlife Management, Land Management, Marine Fisheries, and Information and Education, a draft was presented to the ENSAC which began the external peer review. Shortly thereafter, a review was requested from all relevant federal and state agencies, and the state's larger conservation non-governmental organizations (NGOs).

The second draft incorporated input from peer reviews and public comments represented by a diverse assemblage of groups and organizations involved directly or indirectly in the conservation of New Jersey's wildlife and comprised– to the maximum extent possible – a consensus of the state's wildlife professionals on the actions necessary to protect species of greatest conservation concern. A list of participants assisting in the development of the CWCS can be found in Appendix V. The second stage of the plan, which has begun, involves implementing the strategy and encouraging its use by all of the state's appropriate conservation, planning and regulatory groups.

The success of our CWCS depends on our ability to attract resources to implement the plan through a wide array of existing partners who have influence on wildlife and habitat and new partners who have resources to contribute to the conservation goals.

Our goal is to deliver the strategy to those who have some role in the protection of habitat and/or wildlife or have a mandate to fund conservation initiatives. We want a dialogue that will help us incorporate actions within the strategy that will facilitate implementation by all relevant agencies and groups. To that end, we are conducting two major actions:

1. **Partner Summit:** In spring 2005, we hosted a partner summit to develop the best methods of implementation for all partner agencies and groups. Nine breakout sessions were held within the summit dedicated to important topics, including: Municipal Land-Use Planning, Regional and State Planning, Invasive and Overabundant Species Management, Public Land Management, Land Acquisition (public and private), State and Federal Private Land Incentive Programs, Infrastructure, Habitat Mitigation and Land Use Regulation, and Habitat Restoration and Management. The workshop represented a sincere effort to embrace the ideas of our partners in order to create realistic implementation additions to our CWCS.

1 The ENSP staff incorporated comments and results of the summit, as well as comments we
2 received from the public, into the CWCS. After a final review by the Commissioner of the DEP,
3 the draft strategy will be sent to the USFWS for formal review.
4

5 **2. Online:** The CWCS will be made available online so that it is easily accessible for all
6 interested citizens. The online CWCS is available in a format that enables anyone to find any
7 specific portion of the strategy in which they are interested.
8

9 That formal review will result in the final draft of the CWCS – a document that represents a true
10 consensus of what should be done, and by whom, for the species that are so important to all of
11 us. The federally approved CWCS will then be made available in printed form in libraries
12 throughout the state.
13

B. New Jersey's Landscape Project

The Landscape Project is a proactive, ecosystem-level, geographic information systems (GIS) approach to identifying and delineating areas critical for imperiled and priority concern animal species within New Jersey. The Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP) began the project in 1994 to protect New Jersey's biological diversity by maintaining and enhancing imperiled wildlife populations within healthy, functioning ecosystems.

Landscape Project mapping, the cornerstone of the Comprehensive Wildlife Conservation Strategy (CWCS), explicitly identifies critical habitat for wildlife of greatest conservation need. New Jersey's critical habitats were delineated by first collapsing the NJ Department of Environmental Protection (DEP) aerial photography-based land-use and land-cover information into five habitat categories: forest, grassland, forested wetlands, emergent wetlands, and beach/dune. Next, contiguous patches of habitats were determined from boundaries between different habitat categories and major roads (county level "500" roads). These habitat patches were then intersected with documented occurrences of nongame wildlife species, which are maintained in Biotics. Biotics is NatureServe's biodiversity data management software, which in New Jersey is managed jointly by the NJ Department of Environmental Protection's Office of Natural Lands Management's Natural Heritage Program and the Division of Fish and Wildlife's ENSP. Occurrence records were – and continue to be – derived from a variety of sources, including ENSP surveys, DEP staff reports, private consultant reports and reports from the general public. Habitat patches were then ranked based on the conservation status of the wildlife records and the following ranks assigned: (5) for federal endangered or threatened species, (4) for state endangered species, (3) for state threatened species, and (2) for wildlife species of special conservation concern. A rank of (1) was assigned to patches that have not adequately been surveyed to determine the presence or absence of rare wildlife. Detailed methodologies regarding species models and mapping methodology are provided in the Landscape Project Report (Niles et al. 2004). NOTE: In the map figure "imperiled species" is a convention adopted by ENSP to capture endangered and threatened together (both federal and state).

The Landscape Project is dynamic and can be used at multiple spatial scales to investigate novel approaches to wildlife conservation and wildlife conflicts. The GIS datasets are available to the public for free, allowing a multitude of users to overlay critical habitat with any other GIS layer important to their project. This has allowed users to incorporate critical habitat maps in their planning processes like never before. Landscape Project mapping is the primary source of endangered, threatened and rare wildlife data to private and public organizations and is currently used for land-use regulation, land acquisition through the NJ Department of Environmental Protection's Green Acres Program, state and private land management, private land trusts' management and acquisition, county and municipal planning, and open space acquisition.

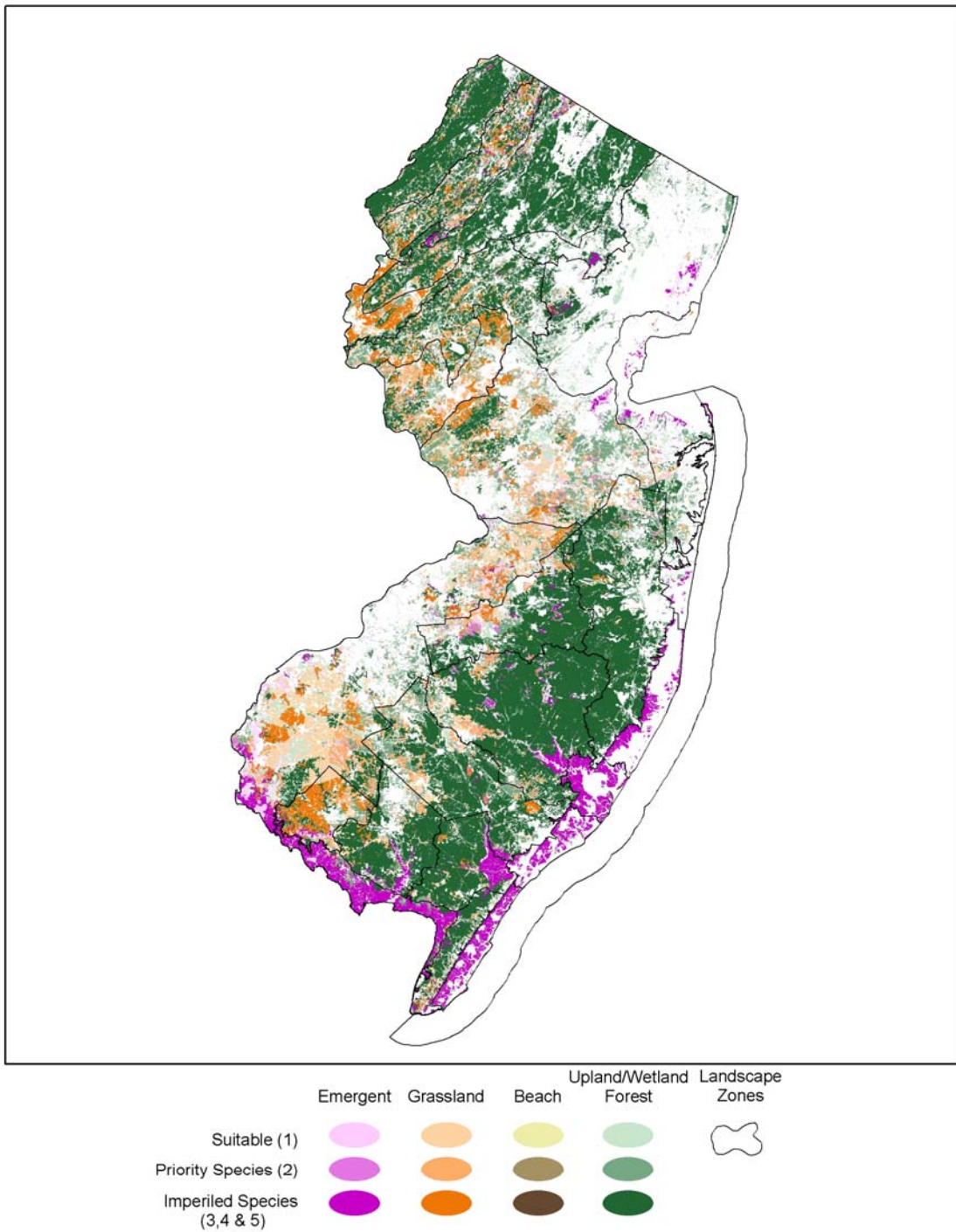
1 More information about the Landscape Project is available from the NJ Division of Fish and
2 Wildlife's website:

3
4 www.njfishandwildlife.com
5

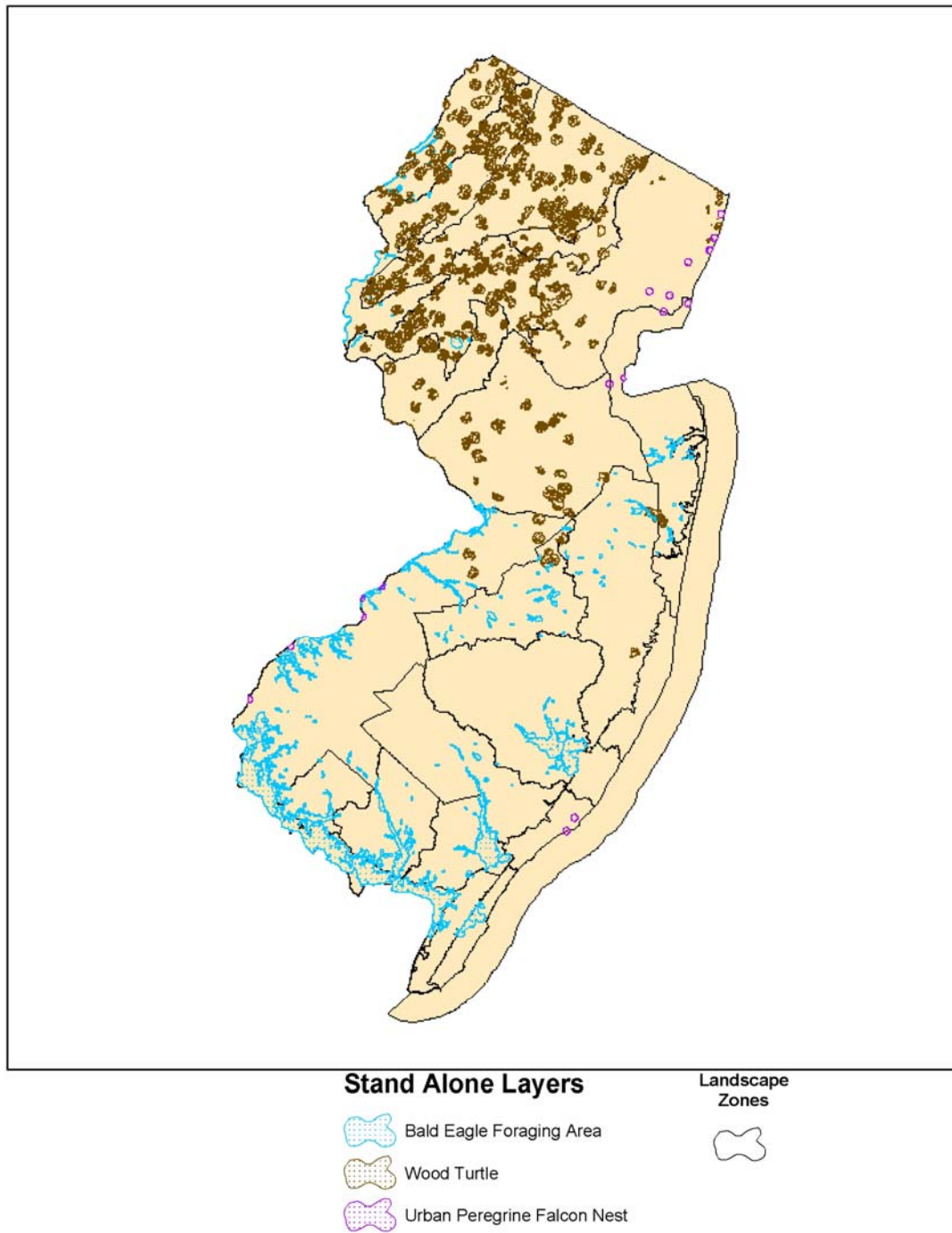
6 Or by contacting:

7
8 The Landscape Project
9 NJ Division of Fish and Wildlife
10 Endangered and Nongame Species Program
11 P.O. Box 400
12 Trenton, NJ 08625
13 (609) 292-9400 or (609) 984-1414 (fax)
14
15
16

1 **Figure 1.** Critical landscape habitats identified through the Landscape Map (v2).



1 **Figure 2.** Stand-alone species' specific critical areas identified through the Landscape Map (v2).



C. New Jersey's Landscape Regions and Conservation Zones

Once glacial ice retreated and the Atlantic Ocean stabilized at its present shoreline, New Jersey blossomed into a state of diverse and unique habitats. Today's dunes, beaches, tidal marshes, cedar swamps, thick pitch pine forests, extensive grasslands, peat bogs, maple-oak forests, pitch pine ridge tops, brackish bays, rivers, streams and the Atlantic Ocean support an amazing array of wildlife. That is true despite the fact that New Jersey is the nation's most densely populated state and home to more than eight million people and much of its diverse landscape has been converted for agriculture or development, fragmented, degraded and altered. Nonetheless, there are tremendous opportunities for conservation of its rich array of wildlife and habitats.

In a state with 10 cities of more than 80,000 people and more than 19,165 square kilometers (7,400 sq. mi.), where should conservation be focused? New Jersey's Landscape Project answers that question by identifying areas of greatest conservation need.

Landscape Regions

Land forms, soils, vegetation and hydrological regimes were used to delineate five ecoregions or landscape regions in New Jersey: the Skylands, Piedmont Plains, Atlantic Coastal, Pinelands and Delaware Bay landscapes.

Skylands Landscape

This landscape region combines two of New Jersey's physiographic regions, the Ridge and Valley and the Highlands. It encompasses all or parts of Sussex, Warren, Hunterdon, Somerset, Passaic, Essex, Bergen, and Morris counties. The region contains extensive tracts of contiguous upland and wetland forests that support diverse animal populations including red-shouldered hawk, northern goshawk, cerulean warbler, timber rattlesnake, long-tailed salamander, and the state's only known wintering populations of Indiana bat. Bog turtles and great blue herons inhabit the extensive freshwater wetland systems found throughout the region.

Piedmont Plains Landscape

This landscape region also combines two of New Jersey's physiographic regions, the Piedmont and the Inner Coastal Plains. It encompasses all or parts of Burlington, Gloucester, Salem, Mercer, Middlesex, Monmouth, Hunterdon, Somerset, Union, Essex, Hudson, Passaic, and Bergen counties. It is dominated by the Delaware and Raritan rivers and is characterized by farmed areas, extensive grasslands, fragmented woodlands and tidal freshwater marshes that are among the world's most productive. Imperiled species within this landscape include grassland birds such as the endangered upland sandpiper and woodland raptors such as the barred owl and Cooper's hawk.

Atlantic Coastal Landscape

This landscape encompasses parts of Monmouth, Ocean, Cape May, and Atlantic counties. New Jersey's Atlantic Coast beaches and marshes are among the most productive coastal habitats in the country. Despite heavy development, they support important portions of Atlantic Coast populations of colonial nesting birds, such as common tern, little blue heron and great egret, and endangered beach-nesting birds such as least tern and piping plover. The coastal habitats also

support most of the state's ospreys, peregrine falcons and northern diamondback terrapins, as well as a large number of northern harriers and large concentrations of wintering waterfowl.

Pinelands Landscape

This landscape encompasses all or parts of Atlantic, Ocean, Burlington, Camden, and Gloucester counties. An internationally recognized ecosystem, the Pinelands supports extremely diverse reptile, amphibian and invertebrate populations including northern pine snake, corn snake, Pine Barrens treefrog, Pine Barrens bluet and arogo skipper. Extensive cedar swamps and wetland systems contain numerous insect species, as well as sustainable populations of many neotropical birds. Its waterways support aquatic communities unique among mid-Atlantic states.

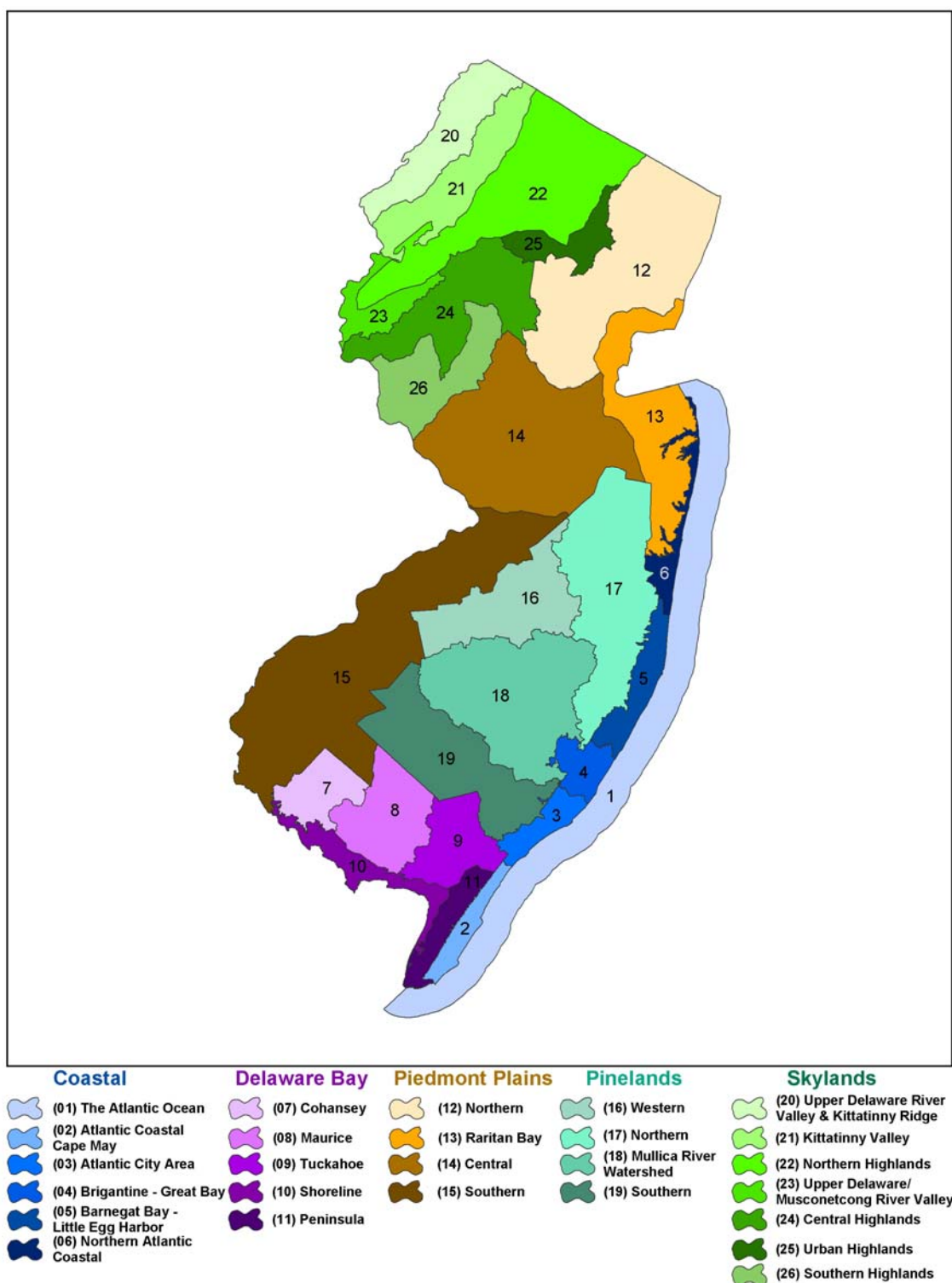
Delaware Bay Landscape

This landscape encompasses all or parts of Cape May, Atlantic and Cumberland counties. It features significant populations of bald eagle, barred owl, eastern tiger salamander, Cope's gray treefrog and 30 other endangered and threatened species. The vast woodland tracts of this region are among the largest in the state and support a large portion of New Jersey's neotropical birds and interior-forest bird populations. The extensive saltwater marsh and sandy overwash beaches support a significant horseshoe crab breeding area and shorebird migration, including the red knot, of worldwide ecological significance. Despite the heavy loss of habitat, the Cape May Peninsula remains one of the country's most important migratory "stopovers" for hundreds of bird and insect species. The expansive habitat mosaic of rivers and streams flowing into the tidal Delaware Bay supports concentrations of rare wildlife and wintering waterfowl.

Conservation Zones

Habitats are variable within each landscape region. Therefore, the regions have been further divided into *Conservation Zones* to identify specific habitat threats and conservation goals. The zones were created using landscape and manmade features within each region.

1 **Figure 3.** Landscape regions identified by the Landscape Map (v2) and conservation zones
 2 within the regions.



3

D. New Jersey's Most Vulnerable Wildlife

This strategy focuses on species of greatest conservation need and many have a legally defined state status which conveys a special conservation need.

The Endangered and Nongame Species Program has solicited the input of biologists to determine the status of each of New Jersey's nongame wildlife species by using the Delphi Status Review. It brings experts together to build consensus – in this case, about the condition of nongame wildlife species (and in some cases, game species) in New Jersey. Bird, reptile and amphibian, freshwater mussel and butterfly biologists participated in different Delphi Status Reviews and provided their opinions about the status of New Jersey species as well as justification for designating these species as endangered, threatened, special concern, secure/stable or unknown. Experts considered the distribution and abundance of wildlife, the condition of their habitats and the threats and problems they might face. Consensus was reached and the review process was completed when 85 percent of the experts agreed on a status for a species.

The Endangered and Nongame Species Advisory Committee recommends the legal status for nongame wildlife in New Jersey, and has followed the results of the Delphi Status Review.

The species of greatest conservation need (Appendix I) include those species that have been identified through scientifically sound data and review processes as species in need of special attention because continued (or further) habitat degradation or modification would result in population losses detrimental to the species' existence within New Jersey, regionally or nationally. The Comprehensive Wildlife Conservation Strategy focuses on endangered, threatened, special concern and regional priority species, species of unknown status (based on the Delphi Status Review recommendations and the New Jersey state legal status), and species identified as extirpated as the result of the Delphi Status Review. The CWCS also includes game species of regional priority, as well as game species that have limited population status information within New Jersey. Nongame species that have been reviewed through the Delphi process and do not have state or regional status, but have been identified by NatureServe Conservation Status Assessment (NatureServe, 2004) as species with a global element rank of G1-G3, have been included among the species of regional priority (Appendix I, Table W6). In addition, species that have not been reviewed through the Delphi process but hold a global element rank of G1-G3 and/or a state element rank of S1-S3, as identified by NatureServe Conservation Status Assessment and the ENSP, have been included among the species of special concern and regional priority (Appendix I, Table W6); this means they are potentially at risk for state and/or regional listing. Definitions for global and state element ranks are shown in Appendix I and can be viewed through NatureServe's web site:

<http://www.natureserve.org/explorer/>.

The regions where such priority species occur are identified in Appendix I, Tables W3 – W9. A complete list of New Jersey's nongame priority species and their associated legal status, current as of August 2005, is shown in Appendix II. The wildlife species addressed in the CWCS are those of greatest conservation concern, specifically those with endangered, threatened, and special concern status in the state. Species of regional priority for which no harvest is permitted are included among the state's species of special concern (Appendix I, Table W6). Through input from DFW's Bureaus of Wildlife Management and Freshwater Fisheries species of regional

1 priority with seasonal harvests within New Jersey have been identified within Table W7
2 (Appendix I); nongame fish species currently without state or regional status have been
3 identified within Table W8 (Appendix I); and species with seasonal harvests, currently without
4 state or regional status, have been identified within Table W9 (Appendix I). Since, ENSP
5 regularly conducts species status assessments using the Delphi Status Review process, a species
6 legal status can change. Therefore, the most current status can be found at
7 www.njfishandwildlife.com or by contacting the ENSP office.
8

9 The CWCS consolidates the results of the Delphi Status Review with ENSP-identified jobs,
10 objectives and approaches outlined in the New Jersey State Wildlife Grants Proposal (ENSP,
11 2002). The CWCS also uses the fine-and-coarse-filter approach by grouping nongame and
12 game wildlife species into ENSP-identified management suites, with common objectives and
13 approaches to conservation (Appendix I, Table W10).
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15 Detailed conservation goals and strategies for each of the wildlife species of greatest
16 conservation need are available in the New Jersey State Wildlife Grants Proposal (ENSP, 2002).
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E. Threats to Wildlife and Habitats

For a complete literature review on impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix III.

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Contents

1. *National and Interstate Threats*
2. *Statewide Threats*

1. National and Interstate Threats:

- Invasive species (both native and exotic terrestrial and aquatic animals, plants, invertebrates, and exotic pathogens) cause significant impacts and permanent loss of terrestrial and aquatic ecosystems. The cost of restoring habitat destroyed by invasive species can be prohibitive and requires persistent and long-term dedicated management. Without swift and significant intervention, losses of natural communities and wildlife may be permanent.
- Suburban “sprawl” and large-acre zoning cause extensive habitat loss and fragmentation. Many communities limit development by creating large-acre zoning. While large-acre zoning (usually five-plus acres) limits the human population within a locality, it dramatically fragments existing habitat, rendering remaining habitat remnants unsuitable for area-sensitive forest and grassland species. Driveways and roads can fragment habitat and limit movement of many wildlife species. Additionally, development degrades patches of adjacent habitat through an increase in predators associated with humans (e.g., raccoons and foxes), and point- and non-point source pollutants (road salt, motor oil, fertilizers, and pesticides). Development may also isolate habitat patches and prevent wildlife movement between patches, which can be particularly devastating to populations that are long-lived and produce few young (such as turtles and snakes). These cumulative impacts of development on wildlife populations and habitats are rarely considered at the regional scale.
- Motorized recreation vehicles on or near public natural lands and waterways (e.g., off-road vehicles and personal watercrafts) cause disturbance and habitat destruction and are major threats to wildlife and their habitats. One of the most destructive aspects of motorized recreation is that it occurs mainly during spring and summer when animals are attempting to breed and plants are in their primary growing season. Acute and chronic noise disturbance can cause animals to abandon suitable breeding areas and/or result in reproductive failure. Motorized vehicles also cause direct mortality of wildlife, especially to reptiles and amphibians.
- Free-roaming house cats kill millions of birds, small mammals and reptiles each year in the United States. Feral cat “colonies” contribute to the problem of anthropogenic (caused by man) wildlife mortality and can eliminate small, isolated wildlife populations, especially in urban settings. Trap, neuter and release (TNR) programs developed by many localities are not a solution and are inherently incompatible with wildlife conservation.
- Oil spills threaten freshwater and salt marsh ecosystems and the wildlife that rely on them. The Atlantic states host an abundance of species that are dependent on riverine and estuarine systems, including larval fish, horseshoe crabs, migratory shorebirds, breeding

eagles and large populations of wintering waterfowl. Heavy oiling kills wildlife, but ingestion of lesser amounts of oil impacts reproduction and survival. In addition, the impacts to aquatic habitats are difficult to quantify and monitor.

- Contaminants from point- and non-point sources degrade habitat and in wildlife cause developmental and behavioral abnormalities and reproductive failure. Substances from point- and non-point sources (e.g. road salt and oil, residential and agricultural fertilizers/pesticides, PCBs and other environmental estrogens and organochlorines, heavy metals, and municipal and commercial wastes) are sources of contamination that can cause aquatic habitats to become unsuitable for invertebrates and vertebrates, cause physical abnormalities in amphibians and chronic reproductive failure in raptors via embryonic death or wasting disease of their hatchlings.
- Overharvesting of horseshoe crabs has diminished the the abundance and availability of horseshoe crab eggs, a critical food source for the red knot (*Calidris canutus rufa*). The dramatic decline in red knot numbers on the Delaware Bay has resulted in the call for federal listing of the red knot. The strong reliance of red knots on horseshoe crab eggs has been evidenced by the declines in red knots concurrent to the declines in horseshoe crabs and horseshoe crab eggs (Clark et al. 1993).

2. Statewide Threats:

Virtually all of the threats faced by New Jersey's wildlife are ultimately linked to human activities. For convenience or organizational clarity, human impacts can be described as "direct" or "indirect". Direct impacts include intentional killing or destruction of animals or their nests or homes, human disturbance, and collection. Without discounting the importance of direct impacts, indirect human impacts pose the greater threat to wildlife. The majority of these are linked to the pattern of human changes to New Jersey's landscape, especially the vast changes brought about by sprawl development over the past half century. Indirect human impacts include habitat destruction, alteration, fragmentation, invasive species' infestation and contamination. Moreover, the NJ Comparative Risk Project Report, written by an independent panel, listed habitat loss and fragmentation as the top risks to NJ ecosystems. Human activities resulting in changes, including changes to the landscape, can benefit some species. However, species that benefit from human activity can, in turn, negatively affect other species or their habitats.

Direct Human Impacts

- Illegal collection of reptiles, butterflies, and freshwater mussels.
- Wanton (and illegal) killing of snakes.
- Vandalism to mines and caves supporting colonies of wintering bats, which are highly susceptible to large-scale mortality during hibernation.
- Recreational use of caves and mines poses a major threat to hibernating Indiana and other wintering bats. These disturbances force bats to unexpectedly arouse from hibernation, thereby depleting critical fat reserves needed to support them through the winter.
- Recreational rock climbing and rock scrambling can make habitats unsuitable for habitat-sensitive, cliff-nesting peregrine falcons and basking/gestating timber rattlesnakes and northern copperheads.

- Recreational use of some beaches disturbs beach-nesting birds, resulting in diminished nesting success and brood survival, and interferes with the foraging and resting of migratory shorebirds.
- Mechanical beach cleaning reduces substrates necessary for foraging by beach-nesting birds and migratory shorebirds.
- Vehicle use on beaches, including permitted private vehicles and “official” vehicles, creates disturbance, harms foraging habitats, can destroy habitats for northeastern beach tiger beetles and causes direct mortality of beach-nesting birds.
- Unlawful off-road vehicle (ORV) use on public land has become a major threat to wildlife habitat. Human disturbance and wildlife mortality from vehicles occur in the most important and intact wildlife habitats in the state. Heavy ORV use renders habitat unsuitable for most wildlife. Other impacts include damage to vegetation, soil compaction, soil erosion and siltation from dirt trails.
- Many commercial fishing practices, including long lines and gill nets, are a threat to sea turtles, whales, pinnipeds (such as seals), pelagic birds, and some fish species such as Atlantic sturgeon. Impacts of aquaculture and back-bay hydraulic crab dredging on marine habitats are largely unmeasured and poorly understood.
- Over-fishing in riparian, estuarine and oceanic systems can reduce reproductive success of colonial waterbirds, bald eagles, ospreys and red knots due to depleted food resources.
- Personal watercraft and recreational boating can cause reduced reproductive success or abandonment of nesting areas and interfere with bird foraging (waterbirds, bald eagles and ospreys).
- Ship strikes pose a threat to sea turtles, pinnipeds and especially whales. Ingestion of plastic (pollution/ litter) also threatens these species.
- Burgeoning predator populations, especially of species that are human-subsidized and/or that are accidentally or purposefully provisioned by people (e.g. feral cats, red foxes, crow species, gull species, raccoons, and skunks), severely impair nesting success and productivity of beach-nesting birds, colonial waterbirds, northern diamondback terrapins, freshwater mussels, songbirds, small mammals, reptiles, and amphibians.
- Unleashed dogs may disturb nest sites and breeding areas of birds, reptiles, amphibians, and small mammals.
- Controlled water releases from reservoirs, along with illegal releases from impoundments, may negatively impact fishes, freshwater mussels, dragonflies, and damselflies, and other aquatic organisms by altering natural flow regimes. Water releases can also affect dissolved oxygen levels downstream during summer months.
- Illegal draw-downs of lakes and ponds during the spring can cause desiccation of spawning nests and egg mortality in fishes. Freshwater mussels, amphibians, and other aquatic species are also at risk.
- Although the potential impacts of offshore wind energy development to migratory and pelagic birds, migratory bats, sea turtles, and marine mammals are poorly understood at this time, offshore wind structures may pose significant threats to these wildlife.
- Water intake systems (e.g. power plants) pose a threat through the entrainment and impingement of aquatic organisms.
- Acoustic effects in freshwater, such as pile driving and underwater drilling, can deter migrating anadromous fishes such as American shad and river herring.

Development

Development eliminates terrestrial and aquatic species habitat and in most cases is irreversible. Moreover, in New Jersey, natural public lands have become a magnet attracting development that surrounds, isolates and potentially degrades natural lands. As described above, the impacts on natural communities from adjacent development can be many, but some of the more significant include the following:

- Lotic and lentic systems (e.g., swiftly and slowly moving streams and waterways) are threatened by land development, including erosion and deposition from storm water discharge, alteration of temperature and nutrient regimes from pavement and lawns, ecological disruption from pesticide applications, and decreased flow due to water draw-downs.
- Increased silt loads and shifting stream bottoms caused by erosion threaten freshwater mussel habitats, as do contaminants such as heavy metals, pesticides, and sewage treatment plant effluent. In addition, increased turbidity deters anadromous fish from completing their normal migration to breeding areas.
- Unspoiled headwater streams are one of the most threatened habitats in North America for fishes and aquatic insects, especially rare dragonflies. Removing the forest canopy can increase water temperatures and silt loading, which can reduce dissolved oxygen levels.
- Groundwater withdraws at headwaters can alter stream flow or cause tributaries and seepages to dry completely. At risk are rare dragonflies and damselflies restricted to these habitats.
- Dragonflies, damselflies, and other aquatic invertebrates also are threatened by alteration or removal of upland forests and fields surrounding the aquatic habitat. These adjacent areas provide critical shelter for newly emerged dragonflies and damselflies and are later used for breeding and foraging.
- Clearing upland vegetation from around wetlands exposes wetlands to increased runoff (siltation and contaminants) and increased desiccation and higher temperatures from exposure to wind and sun. It also favors the establishment of invasive and exotic plants.
- Small freshwater wetlands suffer from lowered water tables caused by heavy residential use of ground water.
- Large wetlands become surrounded by development and become degraded from runoff non-point source pollution, impacts from human disturbance, invasive/exotic plants and introduced mammalian and avian predators, including housecats.
- Removal of snags (e.g. stream cleaning projects), which provide food and shelter for fishes, invertebrates and amphibians, threatens stream communities by decreasing the available detritus that normally accumulates behind stream obstructions.
- Channelization and dredging threatens freshwater mussels, fishes, dragonflies, damselflies, and other aquatic organisms by disrupting stream bottom habitat. These practices also cause higher ranges in tidal volume and a subsequent loss of shallow water habitat, which affects the reproductive success of fish.
- Dams alter the physical, chemical and biological stream environment, sometimes destroying 30-60 percent of the freshwater mussel fauna upstream and downstream of the structure. The most detrimental effect of dams on freshwater mussels, however, is the elimination of host fish species, which disrupts the mussels' reproductive cycles. Dam

construction also results in rare stream dragonflies being replaced by common pond species and blocks the migration of anadromous fishes.

Roads

New Jersey's extensive road network fragments habitat, causes significant wildlife mortality and can present significant barriers to wildlife movement. The impact of vehicular mortality on wildlife populations is only beginning to be quantified. However, some of the more significant impacts are:

- Direct mortality of animals that are slow moving (i.e. reptiles, amphibians), long-lived, produce few young, or already have a small population size can severely impact the viability of that population.
- Roads can act as barriers to wildlife dispersal, which can cause inbreeding and prevent movement when habitat is destroyed or becomes unsuitable, resulting in the direct loss of these individuals from the population.
- Declines in freshwater biodiversity have been attributed to in-stream habitat degradation caused by the removal of forest and the construction of roads and impoundments.
- Traffic noise creates disturbances that render adjacent habitats unsuitable for breeding birds.
- Roads promote dispersal of exotic species, degrade the surrounding environment, and tend to result in new developments, deforestation, and habitat fragmentation.
- Runoff from roads and developed areas degrades water quality (contaminants, erosion, silt deposition) and impacts aquatic wildlife and habitats and the terrestrial wildlife that rely upon them.

White-tailed Deer

High densities of white-tailed deer pose a significant threat to forest health and forest regeneration. New Jersey's progressive deer management strategy and the hunter's contribution through increased antlerless deer harvests have reduced the deer herd in many areas of the state. Damage from deer browse coupled with human-related effects described above severely impact some of New Jersey's remaining public and private natural lands. The unintended consequence is the destruction of some of our remaining natural lands.

- Deer directly damage wildlife habitat and can eliminate rare plant communities.
- High numbers of deer find refuge in residential areas or on private land where hunting is not allowed.
- Over-browse by deer eliminates the native shrub layer, which deprives breeding habitat for many species, particularly shrub-nesting birds.
- Deer over-browse creates a favorable environment for invasive plants to germinate and crowd out native species.
- Deer selectively browse on native species, which allows non-native plants to become established and thrive.

Invasive Species and Exotic Pathogens

New Jersey is currently suffering from an onslaught of invasive, non-indigenous species that threaten the state's natural resources and natural diversity. These include terrestrial and aquatic plants and animals (insects, mollusks) and exotic pathogens. These invasives

negatively impact our forests, streams, lakes, bays, marshes, and backyards. Over 1,000 non-indigenous plant species have become established in New Jersey and many more occur throughout our region but have not yet found their way into the state. Human actions, both non-deliberate and deliberate, are the primary means of invasive species introductions. Some specific examples that occur statewide include:

- Insects such as the Asian long-horned beetle (*Anoplophora glabripennis*), emerald ash borer (*Agrilus planipennis*) and hemlock wooly adelgid (*Adelges tsugae*) kill off large tracts of trees and may significantly change the composition of our forests.
- Sudden oak death fungus (*Phytophthora ramorum*) may severely restrict oak regeneration within our forests and negatively impact the wildlife that relies on oak mast.
- Japanese barberry (*Berberis thunbergii*), tree-of-heaven (*Ailanthus altissima*) and Norway maple (*Acer platanoides*) likely cause long-term loss of forest regeneration and native understory.
- Common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) can severely reduce habitat suitability of freshwater and coastal wetlands for many marsh nesting birds and other species such as bog turtle (*Glyptemys muhlenbergii*).
- Autumn olive (*Elaeagnus umbellata* Thun. var. *parvefolia*), Chinese bush-clover (*Lespedeza cuneata*), Japanese honeysuckle (*Lonicera japonica*) and multi-flora rose (*Rosa multiflora*) impede growth of native grasses, shrubs, and forbs, including host plants and nectar sources for many butterflies.
- Non-indigenous aquatic plant species such as Eurasian water-milfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) reduce the diversity of indigenous aquatic plants, are of less value as a food source for waterfowl and deplete oxygen levels in the water.
- The Asian clam (*Corbicula*) is the most widespread exotic bivalve in North America. Often competing for space and food with native freshwater mussels, *Corbicula* in high densities have been implicated in the decline of native mussels.
- Zebra mussels, not yet reported in New Jersey, pose a significant threat to freshwater ecosystems. All aquatic organisms that are subject to attachment would be at risk. Phytoplankton would also be at risk statewide, as would entire ecosystems that depend on them. All inland freshwater ecosystems could experience dramatic changes in habitat structure and food web dynamics.
- Mute swans (*Cygnus olor*) are established throughout New Jersey and are responsible for excessive herbivory to submerged aquatic vegetation in wetland habitats during key portions of the growing season.
- Exotic fish species, such as the flathead catfish and northern snakehead in the Delaware River drainage, can disrupt aquatic ecosystems by competing for food with native predator species.
- The illegal stocking of carp and grass carp can disrupt benthic (bottom-dwelling) communities and severely impact aquatic vegetation.
- European starlings (*Sturnus vulgaris*) and house wrens compete with many species of woodpeckers and eastern bluebirds for nesting cavities, which is usually the limiting factor for these species.

Unsustainable Land Management Practices on both Private and Conserved Lands and Waters

Approximately 21 percent of New Jersey is protected as federal, state and local lands and through conservation organizations and land trusts (e.g. NJ Audubon Society, The Nature Conservancy, The NJ Conservation Foundation). Although these lands are protected from development, only some lands are actively managed for habitat and wildlife protection. Many natural land areas face the threats listed previously, including over-browse of native plants due to high deer populations, invasive plants replacing native vegetative communities and human disturbance in sensitive areas. At sites where active management occurs, management practices vary according to different organization goals and may not be optimal for maintaining ecological integrity of natural communities, promoting regional biodiversity and protecting critical habitats of rare wildlife. Some practices that could potentially harm native species include:

- Forestry practices, including unsustainable clear cutting and even-aged stand management, can result in forests that are low in vegetative structural diversity, low in living and dead biomass, and consequently, low in biological diversity and ecological integrity.
- Vegetation management, including mowing, cutting and herbicide use on utility rights-of-way and roadsides during the breeding season, increases mortality and reduces productivity of many species, especially birds, invertebrates and small mammals.
- Agricultural use of state lands, particularly Wildlife Management Areas, cultivate crops that do not provide habitat for many species of wildlife.
- Insufficient consideration of the ecology of sensitive habitats when selecting and altering areas for human recreational use causes fragmentation and loss of critical habitat for rare and declining wildlife.
- Lack of active management for wildlife diversity.
- Nutrients from fertilizers used for agriculture, primarily nitrogen and phosphorus, can lead to algae blooms and contribute to eutrophication in aquatic systems. Pesticides, as well as waste from livestock, also threaten waterways. Impacts to aquatic systems and rare species from aquacultural activities are largely unknown, but potential exists for significant negative impacts.

F. State-level Conservation Objectives

Contents of the Chapter on the State-level Conservation Objectives

1. *Addressing National, Interstate, and Statewide Threats*
 - a. *Conservation Goals*
 - b. *Conservation Strategies*
 - c. *Potential Partnerships to Deliver Conservation*
 - d. *Monitoring Success*
 - e. *Information Gaps*
2. *Endangered, Threatened and Rare Wildlife*
3. *The Landscape Project*
4. *Migratory Stopover and Important Bird Areas Planning*
5. *Riparian and Aquatic Species*
6. *Long-term Population Monitoring*

This section identifies the goals and actions (strategies) necessary to address the threats listed in the previous section. In addition, potential partnerships, monitoring programs, and information gaps have also been identified. Moreover, in an effort to emphasize the connection between local and state conservation goals and actions, a “code phrase” has been assigned to each goal that best describes the goals’ general focus. These code phrases have also been assigned to the conservation actions found within the conservation zones throughout this document. The code phrases will assist New Jersey citizens in understanding how local conservation efforts enhance statewide conservation strategies.

1. Addressing National, Inter-state, and Statewide Threats

All of the threats identified above reduce or eliminate wildlife populations over the long term through destruction and degradation of habitat, or in the short term by direct destruction of individual animals. To address these threats adequately, partnerships between and among non-governmental organizations, state agencies, federal agencies, private organizations and private citizens must be developed and cultivated. While we have identified key partnerships throughout this document, partnerships are typically evolutionary in nature and therefore will change and increase over time. Every citizen in New Jersey can play a powerful role in protecting wildlife throughout the state beginning with his or her own backyard.

Invasive Terrestrial and Aquatic Species and Exotic Pathogens

a. Conservation Goals

- Restore and maintain species of special concern wildlife populations through collaborative protection of native species and habitats. (*Conserve wildlife – invasives*)
- Conduct long-term monitoring to evaluate habitat and wildlife restoration efforts. (*Evaluate restoration – invasives*)

b. Conservation Strategies

The approach to controlling invasive plants and organisms must be generalized to all agencies and non-governmental organizations (NGOs) and be multi-pronged with identification, eradication and outreach activities carried out concurrently and continually:

- At a regional scale, identify and frame the problem of invasive plants, organisms, and diseases; prioritize virulence, sources and modes of dispersion and the vulnerability of affected wildlife and plant communities.
- Record any invasive infestations encountered during routine fieldwork or other vegetative monitoring activities with Geographic Positioning System (GPS) units and qualify each site regarding the extent of infestation, vulnerable wildlife and plant species present and the degree of urgency.
- Concurrently, efforts focusing specifically on identifying and mapping infestations should be conducted as funding permits.
- Establish coordinated and consistent priorities based upon an evaluation of the aggressiveness of the infestations, ecological importance of the community or habitat affected, and likelihood of success. . Utilize expert guidance on control methods and develop efficient approaches through expert consensus.
- Prevent new infestations of invasive species by maintaining communication with agencies and conservation organizations in New Jersey and surrounding states to ensure that interstate sightings of exotic freshwater fish species, mollusks, aggressive pathogens, and insects are known and documented.
- Routes of exposure (infestations on private lands) or introduction of new invasive species (through landscape plantings or deliberate dumping of unwanted fish, pets, etc.) should be addressed through aggressive outreach programs aimed at informing landowners, anglers, boaters, water watch groups, gardeners, planners, landscape design groups, etc. about exotic species. Outreach programs should: 1) specifically address the impacts of introduced ornamental plants as a major source of non-indigenous species that invade natural plant communities, 2) minimize the effects of illegal carp stocking by enforcing existing regulations 3) monitor the spread of Asian clams in the Delaware River and tributaries with help from the above named groups, and 4) inform the public about zebra mussel infestation by working with New Jersey Sea Grant.
- Develop species- and habitat- specific “Best Management Practices” (BMPs) for controlling the most common and detrimental invasive species and incorporate understanding invasive species into BMPs developed for other activities such as forestry, wildlife management, stream stabilization, dune stabilization, etc.

c. Potential Partnerships to Deliver Conservation

- DFW will coordinate with experts from universities, conservation organizations, government, and the private sector to provide an overall framework and basis for establishing priorities concerning control of terrestrial and aquatic invasive species and to develop strategies to control infestations on protected lands.
- Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) will work with NJ Sea Grant to inform the public about the threat of a zebra mussel infestation and train people to monitor for them.
- DFW will work with state and county agencies (DEP's Division of Parks and Forestry and Office of Natural Lands Management-Natural Heritage Program, county parks and natural areas) and bordering states' agencies to document and communicate exotic terrestrial and aquatic species occurrences.

- DFW will work with the DEP's Office of Natural Land Management-Natural Heritage Program (NHP) to identify and prioritize management strategies of protected lands impacted by invasive species.
- DFW and conservation organizations will work with water watch groups, river keeper organizations, etc. to identify and report exotic aquatic species occurrences and illegal carp stocking.
- DFW and conservation organizations will partner with the US Fish and Wildlife Service to prevent exotic species introductions and minimize their impacts.
- DFW will investigate reports of illegal carp stocking.

d. Monitoring Success

- Evaluate control efforts by incorporating the collection of necessary information into routine activities and develop funding for dedicated monitoring.

e. Information Gaps

- Encourage research on the long-term impacts of invasive species (e.g., changes in soil pH caused by Japanese barberry), effectiveness of control methods and re-colonization rates of restoration sites.

Suburban Sprawl and Large-acre zoning:

a. Conservation Goals

- Identify and protect breeding, migration, wintering habitats and landscapes essential for long-term viability of wildlife populations. (*Protect habitat - sprawl*)
- Maintain connectivity of habitats at the landscape scale. (*Corridors - sprawl*)
- Encourage creation and enhancement of wildlife habitat on private lands. (*Enhance habitat – private lands*)

b. Conservation Strategies

The approach to ameliorate the effects of continued development in New Jersey will require a large-scale and long-term perspective and will rely mainly on the planning community with major support and technical assistance from the conservation community.

- DFW will lead in the training of municipal and county planners to use the Landscape Map to identify critical wildlife habitats for sensitive species and natural systems within their borders.
- DEP will encourage New Jersey counties and/or municipalities to develop Regional Habitat Conservation Plans within the next 10 years in order to benefit wildlife, habitat and the quality of life for New Jersey citizens.
- County and municipal planners should collaborate in developing master planning documents and ordinances that consider the larger region as a precursor to Habitat Conservation Plans.
- Develop smart-growth plans at the municipal and county level whereby development is clustered and in-fill development maximizes infrastructure efficiency and cost savings while minimizing loss of habitat.
- Establish growth areas within a locality and provide incentives for development within those designated areas while discouraging development outside of those areas.

- Encourage towns to work together to achieve sustainable development. Avoid large-acre zoning as the only mechanism for limiting development due to its unintended consequences: remains of irreparably fragmented habitats.
- Mitigate impacts of development wherever possible by including greenways in municipal and county planning, instituting clustered development, creating/restoring habitat on adjacent private lands through landowner incentive programs, offering backyard habitat initiatives, keeping cats indoors, and promoting low-impact recreational activities on public natural lands.

c. Potential Partnerships to Deliver Conservation

- Government and non-government natural resource agencies to work with municipal and county planners to: develop Habitat Conservation Plans; incorporate wildlife needs while providing citizens green space; and develop smart growth plans that minimize habitat destruction.

d. Monitoring Success

- Continue land cover trend analyses, every five years or fewer, the New Jersey DEP's Bureau of Geographic Information and Analysis in collaboration with the Rutgers University Center for Remote Sensing and Spatial Analysis. Trend analyses conducted for the period of 1986-1995 predicted total build-out in New Jersey in approximately 32 years. With this analysis as a baseline, land cover change monitoring could be used to evaluate success of changes in land-use planning.
- Evaluate possible measures of success, including increases in habitat area via reduction and mitigation of habitat fragmentation; increases in cluster, in-fill and urban development; increases in habitat connectivity; and reductions in the rate of loss of natural lands from large-acre or "sprawl" development.

e. Information Gaps

- Encourage municipalities to acquire GIS capability and proficiency. Promote the use of the Landscape Project in planning efforts by offering technical training to municipal planning authorities.

Motorized Recreation Vehicles

Reducing illegal off-road vehicle (ORV) use and heavy personal watercraft use in sensitive wildlife habitats will require concerted education and law-enforcement efforts and the establishment of legal riding areas. Because of the funds and effort required, law enforcement should focus on areas that are most used by motorized vehicles and most sensitive for terrestrial and water-dependent wildlife.

a. Conservation Goals

- Identify and actively protect public natural lands with rare wildlife and heaviest illegal ORV and personal watercraft use. (*Protect habitat – recreational vehicles*)
- Restore and maintain wildlife populations through the collaborative protection of species and habitats from disturbance and habitat degradation by motorized recreation vehicles. (*Conserve wildlife - recreational vehicles*)
- Conduct long-term monitoring to evaluate protection and restoration efforts of both wildlife and their habitats. (*Evaluate restoration - recreational vehicles*)

b. Conservation Strategies

- Collaborate with off-road organizations and state and non-government agencies to address the problem of unlawful use of public and private natural lands by off-road vehicles.
- Provide areas where off-road vehicle recreation is permitted. Concurrently, increase legal and financial penalties to reduce the prevalence of unlawful off-road vehicle use.
- Areas designated for off-road vehicle use should be selected in accordance with municipal and county Habitat Conservation Plans to allow for the best locations to be selected, (i.e., to minimize impact to important wildlife habitat through direct destruction or proximity to noise disturbance).
- Minimize impact of personal watercraft near significant breeding, roosting, and migratory stopovers for waterbirds, shorebirds, bald eagles, and ospreys (e.g., Hereford Inlet, Barnegat Bay, major rivers and reservoirs) through a seasonal prohibition and increased presence of law enforcement.
- Develop new methods to minimize the impact of personal watercraft on breeding, roosting and migratory avian species.

c. Potential Partnerships to Deliver Conservation

- DFW and conservation organizations will work with private landowners that have rare wildlife and significant vegetative communities on their properties to minimize the impact of off-road vehicles (all terrain vehicles, tractors, trucks, dirt bikes, etc.).
- DFW will work with NJ Audubon Society to develop methods to minimize the impact of personal watercraft on avian species.
- DFW will share site information and expertise with state and federal law enforcement to protect sensitive areas and monitor illegal use of off-road recreation vehicles.

d. Monitoring Success

- Staff and law enforcement personnel to qualitatively monitor ORV use and improvement of habitat condition on state lands. A sample of the most critical and heavily used sites may be monitored for recovery of habitat and wildlife diversity.
- Conduct survey of ORV users through recreation associations to determine their level of satisfaction and use of designated ORV areas.

e. Information Gaps

- Investigate the potential of collaborating with ORV user groups to develop outreach materials on environmental impacts of ORV use on natural lands.
- Siting ORV parks continues to be a difficult problem because communities and those involved in low-impact recreation often do not want high-noise, high-impact recreation activities adjacent to homes, parks, golf courses, etc. This relegates ORV parks to remote areas that are most critical for wildlife. Scenarios for siting ORV parks must be investigated to develop the least disruptive and destructive areas for residents, low-impact users and wildlife.

Free-roaming Feral Cats and Other Subsidized Predators:

Reducing the impacts on native wildlife of subsidized predators such as raccoons (*Procyon*

1 *litor*), red fox (*Vulpes vulpes*), American crow (*Corvus brachyrhynchos*) and free-roaming
 2 “owned” and feral cats will require the concerted effort of many government and non-
 3 government agencies, but must commence with an aggressive and thoughtful public outreach
 4 campaign. Such a campaign should be developed via the collaboration of wildlife biologists, the
 5 veterinary community, environmental educators and representatives from local and county
 6 animal shelters and advocacy groups.

7 **a. Conservation Goals**

- 8 • Reduce impact on wildlife populations of subsidized predator populations, including free-
 9 roaming and feral cats. (*Conserve Wildlife – cats, subsidized predators*)

11 **b. Conservation Strategies**

- 12 • Educate the public about the negative impacts of free-roaming cats (“owned” and feral) on
 13 New Jersey’s native wildlife through public service announcements, brochures, public
 14 presentations, etc. These materials should be grounded in, and clearly cite, current research
 15 on the impacts of cats on wildlife.
- 16 • Provide educational materials at all public and non-government organization natural land
 17 areas.
- 18 • Cat colonies, including those managed by Trap, Neuter and Release (TNR) programs must be
 19 eliminated from areas where there are concentrations of vulnerable native wildlife, especially
 20 endangered and threatened species (e.g., beach-nesting bird colonies). Such action must be
 21 accompanied by proactive efforts targeted at local residents, business owners, and land
 22 managers to reduce resources that encourage re-colonization by feral cats (e.g., securing
 23 dumpsters and trash cans, removing sources of shelter, removing rubbish piles where rodents
 24 can be abundant).
- 25 • Encourage research to develop better information on the impacts of feral and free-roaming
 26 cats on native wildlife populations.
- 27 • Develop and implement management practices to reduce predation on native wildlife such as
 28 predator exclosures and electric fences.
- 29 • Conduct appropriately focused integrated wildlife damage management in areas where
 30 predators are significantly diminishing reproductive success of wildlife species of concern.
- 31 • Work with local municipalities to develop policies and/or establish regulations that minimize
 32 the impacts of predators on native wildlife species, including bans on “managed” cat colonies
 33 and feeding of wildlife near critical wildlife areas.

35 **c. Potential Partnerships to Deliver Conservation**

- 36 • Government and non-government wildlife biologists, the veterinary community,
 37 environmental educators, and representatives from local and county animal shelters should
 38 collaborate on educational materials regarding the negative impact of feral and free-roaming
 39 cats on native wildlife and methods for pet owners to minimize those impacts.
- 40 • DFW and NJ Audubon Society will continue to work with American Bird Conservancy’s
 41 “Cats Indoors” program to develop outreach materials, press releases, and partnerships with
 42 local conservation organizations.
- 43 • DFW will work with and encourage conservation organizations to include educational
 44 materials regarding free-ranging house cats and feral cats within their constituency
 45 newsletters (e.g. Conserve Wildlife Foundation, NJ Audubon Society, The Nature
 46 Conservancy-NJ Chapter).

d. Monitoring Success

- Establish long-term monitoring efforts where concentrations of vulnerable wildlife exist and where active control or management of feral cats is being conducted.

e. Information Gaps

- Pursue a comprehensive peer-reviewed paper compiling results of current research worldwide on the impact of cats to native wildlife.
- Develop and distribute recommendations for control and management of cats that are reasonable and effective to protect native wildlife populations.
- Launch a public outreach campaign, possibly through the creation of a thoughtful documentary about cats and wildlife that could be shown on public television stations nationwide.
- Develop a better understanding of the effectiveness of TNR programs in effecting reductions in feral cat populations.

Oil Spills**a. Conservation Goals**

- Identify and protect breeding, migratory, and wintering habitats and landscapes essential for long-term viability of wildlife populations with an emphasis on habitats supporting endangered, threatened, and declining wildlife. (*Protect habitat – oil*)

b. Conservation Strategies

- Use the Landscape Map as the basis for emergency response planning and prioritization of species and habitats at the state and county level.
- Develop specific plans for the highest priority species (e.g., Delaware Bay and migratory shorebirds, wintering waterfowl) and most vulnerable habitats (e.g., Delaware River and Bay). Keep plans current by including information gained from recent spill events and new information on species distributions.
- Revisit the oil-spill response plans for the Delaware Bay and other sensitive areas like the New York Harbor, incorporate updated information and mapping on priority wildlife areas, and include criteria to evaluate the effectiveness of New Jersey's response to oil spills. Evaluation criteria should be based on experience with past responses to oil spills.

c. Potential Partnerships to Deliver Conservation

- State and county emergency response planners, local officials, state, federal and non-government biologists and geographic information system (GIS) experts should develop mapping for oil-spill response that prioritizes sites.
- State and federal members, including the Department of Interior (USFWS), US Coast Guard, Department of Commerce (NOAA) and NJDEP Office of Natural Resource Restoration, in addition to a dedicated team comprised of non-government organizations including Tri-State Bird Rescue and Research, Inc., will work to develop the evaluation methodology of New Jersey's response to oil spills. This evaluation method should assess the extent of the areas affected, the timeliness and effectiveness of the response and impacts to wildlife and habitat.

d. Monitoring Success

- Continue to improve the emergency response and clean-up process by reviewing information compiled from spill events and evaluating monitoring criteria.
- Develop a long-term monitoring plan in which wildlife and habitats are surveyed at least one year after a spill to assess whether the ecosystem is still experiencing impacts.

e. Information Gaps

- Long- and short-term impacts to benthic (bottom-dwelling aquatic) communities.
- Long- and short-term impacts on wildlife productivity due to the bioaccumulation of contaminants in food resources.

Contaminants (point and non-point sources)

a. Conservation Goals

- Restore and maintain wildlife populations through the collaborative protection of species and habitats. (*Conserve wildlife – contaminants*)
- Conduct long-term monitoring to evaluate population viability and protection and restoration efforts of both wildlife and their habitats. (*Evaluate restoration – contaminants*)

b. Conservation Strategies

- Reduce contaminants in the environment through a multi-pronged approach that includes consideration and reduction of sources via municipal and county planning, contaminants monitoring by the NJ DEP, and contaminants monitoring in wildlife by the DFW (particularly heavy metals, pesticides, organochlorines, PCBs, and other environmental estrogens).
- Analyze tissues of raptors and waterbirds on a regular basis using 1) failed eggs, 2) nestling blood, 3) adults found dead, and 4) adults, where appropriate, to assess contaminant levels and determine causes of mortality and nest failures.
- Expand efforts with DEP's Division of Water Quality to analyze and attempt to minimize contaminants in the water.
- Analyze tissues of actual or typical prey items and the environment of nest areas for contaminants to assess the level of contaminants and determine the threat within the food web.
- Work with state and federal hazardous site cleanup programs to reduce exposures to contaminants.

c. Potential Partnerships to Deliver Conservation

- DFW will continue to work collaboratively with the DEP's Divisions of Science, Research and Technology and Watershed Management to monitor water quality and aquatic communities (fish and invertebrates).
- DFW will continue to work collaboratively with Tri-State Bird Rescue and Research, Inc., US Fish and Wildlife Service, and DEP programs to monitor bald eagles for contaminants.
- DFW to work collaboratively with research and management agencies and universities to investigate the role of contaminants as limiting factors to population growth for wildlife of concern.
- DFW's Herptile Atlas and vernal pool volunteers will be enlisted to report deformities in amphibians.

- DFW will continue to monitor and manage bald eagle nest sites through volunteers.
- DFW will continue cooperative work with the DEP to determine the relative threats of known pollution locations and sources, maintaining raptors and amphibians as key indicators of contaminant levels in the state.
- DFW will work with State and federal members, including the Department of Interior (USFWS), US Coast Guard, Department of Commerce (NOAA) and NJDEP Office of Natural Resource Restoration and Site Remediation Programs to build restoration in to hazardous site clean ups and remedies.

d. Monitoring Success

- Reports on contaminants in wildlife will continue to be produced by the DFW.

e. Information Gaps

- Long- and short-term impacts to benthic (bottom-dwelling aquatic) communities.
- Long- and short-term impacts on wildlife productivity due to the bioaccumulation of contaminants in food resources.

Direct Human Impacts on Native Wildlife and Ecosystem Health

a. Conservation Goals

- Eliminate illegal collection of reptiles and amphibians within New Jersey and the release of unwanted exotic species into New Jersey's natural environment. (*Protect wildlife - humans*)
- Identify, protect and minimize human disturbance at sensitive locations (nests, hibernacula, breeding pools, critical concentration or feeding areas, etc.). (*Protect habitat - humans*)
- Minimize impacts of controlled water releases on fishes, freshwater mussels, dragonflies, damselflies, and other aquatic organisms. (*Protect aquatic wildlife - humans*)
- Minimize impacts of illegal draw-downs by enforcing existing regulations.
- Minimize impacts of water intake systems on aquatic organisms.
- Minimize acoustic effects to anadromous freshwater fishes and marine mammals and turtles.
- Promote public awareness and conservation. (*Education – humans*)
- Minimize impacts of snag removal and stream cleaning on aquatic species. (*Protect habitat– humans*)

b. Conservation Strategies

- Continue collecting rare species' location data and incorporating these data into the Landscape Map.
- Increase protection of sensitive habitats at risk of frequent human disturbance through law enforcement, protective barriers such as gates restricting entry to bat hibernacula, and public monitoring/ reporting of illegal activity.
- Continue monitoring impacts of unlawful off-road vehicle (ORV) use to wildlife and increase enforcement in areas where unlawful ORV use is known to occur.
- Investigate impacts of personal watercraft on the productivity of colonial waterbirds, beach nesting birds and ospreys.
- Continue monitoring osprey and colonial waterbird nest sites.
- Investigate impacts of controlled water releases on aquatic organisms (e.g. freshwater mussels) through current and future research.

- Investigate reports of illegal draw-downs and enforce existing regulations.
- Continue to review such data as biological assessments from existing power plants and provide recommendations to minimize impingement/entrainment impacts.
- Continue reviewing stream encroachment and other permit applications and apply seasonal restrictions on acoustic intrusions.
- Develop statewide outreach programs to educate citizens about New Jersey's ecosystems, natural communities, and state laws and restrictions.
- Develop responsible ecotourism opportunities to foster appreciation for New Jersey's biological diversity and greater understanding of the economic benefits of wildlife.

c. Potential Partnerships to Deliver Conservation

- DFW, conservation organizations and environmental educators will develop and implement statewide outreach programs to increase conservation awareness about New Jersey's natural history, native wildlife and state laws and restrictions. Encourage the establishment of environmental programs such as Project Wild throughout New Jersey's schools.
- DFW will work with state and federal law enforcement to develop and implement a plan to increase protection at sensitive areas (nests, hibernacula, breeding sites, etc.).
- DFW and conservation organizations will collaborate on survey and monitoring techniques of reptile and amphibian populations.
- DFW will work with rock-climbing organizations to educate their constituents and to minimize disturbance at sensitive areas (gestation and basking sites, nest sites, etc.).
- DFW, conservation organizations, and land trusts will collaborate with citizen resource groups (bird watching, hunt clubs, bird-dog training groups) to monitor and protect preserved lands from unlawful ORV use, illegal collection of reptiles and amphibians, vandalism to critical sites (nests, hibernacula), and illegal dumping.
- DFW will develop a plan to improve the efficiency of receiving and responding to public reports of illegal or unsafe activities/ events. Increase fines where appropriate.
- DFW will work with USFWS to develop a plan to monitor the taking of non-target species by commercial fisheries and determine if alternative methods can be used that will minimize the impact on rare fish.
- DFW will investigate incidents of illegal draw-downs and enforce existing regulations.
- Work with the National Marine Fisheries Service (NMFS) and the USFWS on water intake system impacts.
- DEP will work with water watch groups, river keeper associations, and other organizations to report illegal draw-downs.
- DFW will collaborate on environmental reviews to ensure that seasonal restrictions are applied during migration periods.
- Work with the US Army Corps of Engineers, Delaware River Keeper, Delaware River Basin Commission, US Coast Guard, bridge authorities and other groups on issues related to acoustic effects in waterways.

d. Monitoring Success

- Monitor short- and long-term effects of commercial fisheries' practices on populations offish and bird species of conservation concern.

- Monitor reptile and amphibian populations through volunteer programs (Herptile Atlas, vernal pool project, etc.).
- Continue to monitor wintering bat populations at known hibernacula and monitor human disturbance at potential hibernacula that currently are not protected.
- Continue Mid-Winter Waterfowl Surveys.

e. Information Gaps

- Gather information to determine cumulative impacts on reptile and amphibian populations from direct human activity (e.g. collection, wanton killing, destruction of critical habitat, and illegal draw-down of waterways).

Development

a. Conservation Goals

- Identify and protect breeding, migration, wintering habitats and landscapes essential for the long-term viability of endangered, threatened and declining wildlife populations. (*Protect habitat – development*)
- Restore and maintain wildlife populations through collaborative protection of species and habitats. (*Conserve wildlife - development*)
- Conduct long-term monitoring to evaluate population viability, protection and restoration efforts of both wildlife and their habitats. (*Evaluate restoration - development*)
- Minimize impacts of dredging, channelization and dam construction on aquatic species. (*Protect habitat – development*)
- Minimize impacts of snag removal and stream cleaning on aquatic species.
- Restore historic anadromous fish spawning habitat to what it was before dam installation to increase population size. (*Restore aquatic habitat – development*)
- Minimize acoustic effects to anadromous freshwater fishes and marine mammals and turtles.

b. Conservation Strategies

- Decrease isolation of public natural lands by development.
- Use the Landscape Map to identify areas of important habitat to focus backyard habitat programs such as the stopover project (NJ Division of Fish and Wildlife), certified backyard habitat (National Wildlife Federation), and backyard habitat with native plants (NJ Audubon Society).
- Create and enhance habitat adjacent to and between public lands to increase the effective size and connectivity of public natural lands and environmentally sensitive areas.
- Develop a “one-stop shop” program for landowners interested in habitat enhancement programs. Landowners will receive guidance on the program best suited for their individual needs and their habitat within the context of the regional landscape.
- Secure state funding for the Division of Fish and Wildlife’s Environmental Review Office to allow continued review of stream cleaning and stream encroachment permit applications.
- Enforce existing regulations to prevent illegal stream cleaning or snag removal activities.
- Where appropriate, install fish ladders to assist passage of anadromous fish in areas with dams; monitor passage as necessary.

c. Potential Partnerships to Deliver Conservation

- DFW and the Division of Parks and Forestry (DPF) will work with government and non-government organizations that currently have habitat programs in place to decrease isolation of public natural lands by development.
- Federal, state, and non-government organizations to identify focus sites and educate the public about backyard habitat programs that benefit New Jersey's native wildlife and plant communities.
- DFW is collaborating with the US Department of Agriculture's Natural Resources Conservation Service (NRCS), conservation organizations (NJ Audubon Society, The Nature Conservancy – NJ Chapter, Ducks Unlimited, Ruffed Grouse Society, Pheasants Forever, Trout Unlimited, Turkey Federation, Quail Unlimited), and the USFWS NJ Field Office to develop a more simplified program for landowners interested in habitat enhancement programs.
 - DEP will partner with river keeper associations, water watch groups, etc., so that they will report illegal snag removal or stream cleaning activities.
 - DEP will work with the US Army Corps of Engineers, US Fish and Wildlife Service and other groups on issues related to dredging and channelization when appropriate.

d. Monitoring Success

- Conduct large-scale monitoring via land cover change analyses every five years to monitor change in extent, connectivity and fragmentation of habitats statewide. Link this analysis with large-scale monitoring activities for birds, reptiles and amphibians to develop trends for species and habitats.
- Continue to monitor rare reptile and amphibian populations within isolated habitats for presence, genetic isolation and its effects on populations and breeding success.

e. Information Gaps

- Gather information to determine the cumulative impacts of collisions with man-made structures on populations of rare bird species.

Road Mortality of Wildlife

a. Conservation Goals

- Identify and protect breeding, migratory, wintering habitats and landscapes essential for long-term viability of endangered, threatened and declining wildlife populations. (*Protect habitat - roads*) and (*Corridors – roads*)
- Conduct long-term monitoring to evaluate population viability, protection and restoration efforts of both wildlife and their habitat. (*Evaluate restoration - roads*)

b. Conservation Strategies

- Identify and map (using a global positioning system) known areas where wildlife are repeatedly killed (e.g., amphibian breeding ponds close to roads, bobcat kill locations). These areas can be identified with data from Biotics, ENSP staff and the ENSP's Herptile Atlas, Amphibian Crossing Survey and Vernal Pool volunteers.
- Develop solutions for identified road mortality sites (barriers along the road or underpasses if road improvement activities take place in the future).

- Develop possibilities for road construction in sensitive areas that facilitate wildlife passage across or under roads through raised road systems and under bridges. Making the road network more passable for wildlife will help with dispersal and reduce vehicular mortality.
- Conduct surveys at known amphibian migration corridors to collect data regarding species that are present and potential mortality rates. Collect habitat information at these sites to develop a model that can be used to identify potential amphibian crossings statewide and can be incorporated into local and county plans for development and protection.

c. Potential Partnerships to Deliver Conservation

- Government and non-government agencies and engineers from the NJ Department of Transportation can work together to develop methods to minimize or eliminate road mortality at specific sites.
- DFW will work with local and county planners and road departments to consider and incorporate known amphibian migration corridors into perspective Habitat Conservation Plans and Smart Growth plans.

d. Monitoring Success

- Develop funding to conduct seasonal surveys in areas identified as high mortality sites. Collaborative development and implementation of solutions to reduce acute, seasonal mortality at some of these sites presents an opportunity to carry out before-and-after surveys to assess efficacy of solutions.

e. Information Gaps

- Gather information, conduct research and evaluate the effectiveness of under- and over-road passages for wildlife.

High Deer Densities

The best approach for this problem is to encourage private and public landowners including private conservation lands to allow hunting on their properties. These efforts should be accompanied by a public outreach effort stressing the need for deer hunting for effective deer management that includes public presentations by biologists from organizations such as NJ Division of Fish and Wildlife, NJ Audubon Society, and the NJ Conservation Foundation. The joint credibility of these biologists can encourage non-hunting landowners to allow hunting access by educating them about the damage caused by overabundant deer populations.

a. Conservation Goals

- Restore and maintain wildlife populations through collaborative protection of species and habitats. (*Conserve wildlife - deer*)
- Conduct long-term monitoring to evaluate population viability, protection and restoration efforts of both wildlife and their habitat. (*Evaluate restoration - deer*)

b. Conservation Strategies

- Conduct forest health surveys and use forest health indices as a factor in developing deer management goals.
- Work with private landowners and municipalities to control deer via volunteer hunters working in cooperation with the DFW on specialized controlled hunts that meet the needs of various property owners.

- Develop and implement, through regulation or legislation, programs that support increased hunter access and hunting opportunities like reduction of safety zone for bow hunting and Sunday hunting.
- Develop and implement, through regulation or legislation, programs that require farmers to achieve deer management goals, including harvest quotas, in order to obtain farm tax assessment or to qualify for farmland preservation programs.
- Institute measures to require addressing deer management in plans developed by the US Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) for any farm property that receives state or federal funding. The plans must include harvest quotas and mechanisms to insure implementation.
- Continue research into contraceptive approaches to reducing deer populations.
- Seek full funding for the Hunters Helping the Hungry venison donation program, which allows hunters to donate venison to food kitchens.

c. Potential Partnerships to Deliver Conservation

- DFW will continue to work with the Fish and Game Council to include Game Code provisions that increase deer hunter access and hunting opportunities building on the success of the deer management strategy in areas with good hunter access.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, DFW will work with landowners to develop and implement deer management plans that achieve desired deer densities.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs and other farm conservation programs.
- DFW will work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.
- DFW and DEP's Division of Parks and Forestry (DPF) will partner with Rutgers University and other academic institutions to conduct studies necessary to better understand the impacts of deer on biodiversity, forest health and ecosystem processes, and to develop habitat-specific or landscape-specific deer density targets.
- DFW will work with the USDA's NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW will work with land management agencies at the state, local, and federal levels to implement deer management plans that achieve desired deer densities on lands that they oversee.

d. Monitoring Success

- Monitor forest health and regeneration as an index of success of deer management efforts.
- Continue to monitor deer harvest and deer densities.

e. Information Gaps

- Evaluate effectiveness of contraception methods to control deer populations through review of current literature and assessment of feasibility for use in New Jersey.

Unsustainable Land Management Practices on both Private and Conserved Lands and Waters

a. Conservation Goals

- Minimize impacts of agricultural practices on aquatic waterways, ground-nesting birds, reptiles and amphibians. (*Agriculture – land management*)
- Improve communication between farmers, state and private foresters and land stewards of private, local, state and federal lands to develop silviculture plans that enhance habitats for species of conservation concern and maintain or improve the ecological integrity of the natural community. (*Silviculture – land management*)
- Investigate impacts of aquaculture on critical habitats and wildlife and develop BMPs to minimize negative impacts. (*Aquaculture – land management*)
- Minimize impacts of other potentially deleterious land management practices, such as dune stabilization, stream cleaning, shoreline stabilization, etc., on critical habitats and wildlife. (*Other practices – land management*)

b. Conservation Strategies

- Minimize impacts of fertilizers, pesticides, livestock, etc., on waterways by maintaining adequate buffers and, when feasible, enhancing riparian areas through stream bank restoration efforts.
- Protect endangered and threatened aquatic species by upgrading stream classifications to Category One in critical areas.
- Educate private landowners on the benefits of participating in programs such as Forest Stewardship, the Landowner Incentive Program (LIP), the Wildlife Habitat Incentives Program (WHIP) and other US Department of Agriculture programs, and various others that advocate best management practices (BMPs) for forestry and agriculture.
- Delay mowing of hayfields and fallow fields until after July 15th to permit rare ground-nesting birds to fledge one brood; leave standing grass in fields for winter cover.
- Develop BMPs addressing wildlife and habitat impacts of various land management practices such as forestry, agriculture, dune stabilization, stream stabilization, aquaculture, etc.

c. Potential Partnerships to Deliver Conservation

- DFW will work with DEP's Bureau of Water Monitoring and Standards to upgrade stream classifications to Category One in segments with endangered or threatened aquatic species present.
- DFW will work with landowners to minimize impacts on waterways by maintaining adequate buffers and enhancing riparian areas through stream bank restoration efforts.
- DFW will work with farmers, state and private foresters and land stewards of private, local, state, and federal lands to implement best management practices that will benefit New Jersey's rare wildlife and natural communities (altered mowing, raising mower blades, controlled or "spot" pesticide application, sustainable forestry practices, etc.)

d. Monitoring Success

- Track the amount of acreage that is enrolled in the various federal and state programs that encourage best management practices.
- Track invasive species removal and re-growth.

1 e. Information Gaps

- 2 • Acquire historic and current data from the Division of Parks and Forests regarding the
- 3 location, date, and type of silvicultural or other management practice conducted on public
- 4 lands.
- 5 • Identify areas impacted by invasive species.

8 2. Endangered, Threatened, and Rare Wildlife

9 New Jersey's nongame wildlife list (as identified under Endangered and Nongame Species
10 Conservation Act (Act), N.J.S.A. 23:2A-1 et. seq; N.J.A.C. 7:25-4.17) currently does not include
11 arthropods, mollusks or fish unless they have been listed as federal or state endangered or
12 threatened. The Division of Fish and Wildlife's Endangered and Nongame Species Program
13 (ENSP) believes that there are species of special concern within these suites that are in need of
14 protection and management assistance and have included them among the species listed within
15 the Strategy. The ENSP intends to address this disparity within the Act and include fish and
16 arthropods on the nongame list in the near future.

17
18 Part I of the State Comprehensive Wildlife Conservation Strategy focuses wildlife and habitat
19 conservation goals on New Jersey's endangered, threatened and rare wildlife. Species of state
20 concern have been identified within the wildlife tables W2 – W6 in Appendix I and include
21 federal endangered and threatened species, state endangered, threatened, and species of special
22 concern, and species of regional priority.

24 a. Conservation Goals

- 25 • Maintain viable populations of all rare and nongame wildlife species to ensure their long-
- 26 term participation in the ecosystems of New Jersey. Restore populations of endangered and
- 27 threatened wildlife to stable levels that allow their delisting. (*Conserve wildlife – rare*
- 28 *wildlife*)

30 b. Conservation Strategies

- 31 • Regularly review the population status of native nongame wildlife, using the Delphi Status
- 32 Review, to identify those species in decline or meeting endangered and threatened
- 33 classification.
- 34 • Measure population levels, identify limiting factors and develop recovery goals and plans for
- 35 species of greatest priority.
- 36 • Manage to reduce threats and improve habitat conditions. Monitor population parameters
- 37 and limiting factors and adapt management to maximize population and productivity.
- 38 • Promote habitat conservation to meet the habitat requirements of wildlife at restored and
- 39 viable population levels.
- 40 • Maintain populations of rare wildlife at levels that complement complete, viable functioning
- 41 ecosystems.
- 42 • Expand and exploit opportunities to restore, create, and enhance habitats for rare wildlife
- 43 where appropriate.
- 44 • Continue to develop and improve habitat creation and restoration technologies.

c. Potential Partnerships to Deliver Conservation

- DFW will coordinate with species experts from universities, conservation organizations, government and private sectors to participate in the Delphi process to review and classify species status.
- DFW will develop new species information in partnership with the US Fish and Wildlife Service, universities, conservation organizations such as NJ Audubon Society, NJ Conservation Foundation and The Nature Conservancy-NJ Chapter, regional wildlife planning groups, and private consultants to track wildlife trends. Develop species recovery goals and plans with assistance from these groups and individuals.
- DFW will maintain a corps of Citizen Scientist volunteers who collect data on species presence and abundance, contributing to wildlife trend information and data that supports the Landscape Project's critical habitat designations.
- DFW will identify significant habitats for endangered and threatened wildlife on public and conservation lands and coordinate with land managers to enhance habitats.
- DFW will identify significant habitats on private lands (particularly those adjacent to public and conservation lands) and work with landowners to promote management beneficial to rare wildlife.

d. Monitoring Success

- Regularly review the population status of native nongame wildlife to evaluate trends and re-evaluate official status designations.
- Regularly review species recovery and habitat goals predicted to support recovered populations.

e. Information Gaps

- Pursue information on species occurring in the state whose statuses are designated as "unknown."
- Pursue research necessary to establish recovery goals relative to population, productivity and habitat requirements.

3. The Landscape Project

For additional information regarding the Landscape Project, see Appendix IV or visit our website: www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

a. Conservation Goals

- Identify and protect landscapes and habitats essential for long-term viability of wildlife and fish populations of conservation concern. (*Protect habitat – Landscape Project*)

b. Conservation Strategies

- Collect data and maintain the Biotics database to define the current range and abundance of rare wildlife, including mammals, birds, reptiles, amphibians, mollusks, butterflies and other invertebrates.
- Design, refine and publish critical habitat designations using current data on rare wildlife populations in both terrestrial and riparian habitats.

- Build models that define habitats for those species lacking models. Refine existing models based on new information.
- Apply knowledge of critical habitat locations to create guidance on land management, habitat conservation, land acquisition and land planning at all levels of government and non-government organizations.
- Develop site-based management plans using the Landscape Project and principles of landscape ecology as foundation.
- Cross-walk existing site-based plans for National Wildlife Refuges, military bases, and other public lands against this strategy (CWCS) and make appropriate changes.
- Use designation of special resource areas under the New Jersey State Development and Redevelopment plan and other protective planning such as marine protected areas to recognize and afford protection to landscapes of critical importance to conserving regional biodiversity.

c. Potential Partnerships to Deliver Conservation

- DFW will continue coordinating with landscape ecology experts to review and adapt the methodology applied in the Landscape Project habitat mapping and species modeling.
- DFW will maintain a corps of Citizen Scientist volunteers who collect data on species presence and abundance, contributing to wildlife trend information and data that supports the Landscape Project's critical habitat designations.
- DFW will coordinate with state experts, the National Bird Monitoring Committee, Partners In Flight, and other regional and national efforts to integrate new and existing data into national and regional planning.
- DFW will identify significant habitats on public and conservation lands and coordinate with land managers to enhance habitats. DFW will identify significant habitats on adjacent private lands and work with landowners to promote management beneficial to rare wildlife.
- DFW will continue to work with Department of Environmental Protection (DEP) agencies to apply the Landscape Project to guide regulatory protection of habitats.
- DFW will work with conservation organizations, the Association of NJ Environmental Commissions, county and local governments, and private citizens to apply Landscape Project planning statewide.

d. Monitoring Success

- Track habitat protection and loss relative to Landscape Project designations.
- Track the populations and distribution of rare species and adapt the Landscape Project's conservation strategies as needed.
- Collect data on habitat parameters to identify trends and adapt management techniques as necessary to reach rare wildlife population and habitat goals.

e. Information Gaps

- Continue to improve accuracy of base map land use/land cover.
- Pursue rare species information for habitat parcels that have the rank of 1 (meets minimum area requirement but has no known species occurrences) in Landscape Project mapping.
- Educate private citizens and conservation and government organizations about reporting occurrences of rare species.

4. Migratory Stopover and Important Bird Areas Planning

a. Conservation Goals

- Identify, monitor, conserve, and improve key migratory corridors and stopover locations for migratory birds. (*Corridors – migratory birds*)
- Conserve sites critical to breeding and wintering birds. (*Protect habitat – migratory birds*)

b. Conservation Strategies

- Conduct surveys of migrating passerines and raptors at major stopover areas in the state, primarily the Cape May Peninsula.
- Survey and monitor shorebird populations along the Delaware Bayshore stopover.
- Conduct baseline surveys of other stopover areas such as Sandy Hook, Island Beach, and inland habitats important to migrating birds.
- Develop plans to improve and preserve existing habitat.
- Develop land acquisition and management strategies to conserve stopover resources.
- Identify a network of locations that will help sustain naturally occurring populations of birds and birding sites in New Jersey.
- Ensure the continued viability of these habitats by producing a set of recommendations for the conservation of Important Bird Areas (IBA) statewide.
- Raise public awareness about the value of habitat for birds and other wildlife.
- Conduct the annual Mid-Winter Waterfowl Survey and the Atlantic Flyway Breeding Waterfowl Survey.

c. Potential Partnerships to Deliver Conservation

- DFW will work with public land managers, NJ Conservation Foundation (NJCF), The Nature Conservancy-NJ Chapter (TNC), other landowning conservation organizations and private landowners to create and enhance habitats for migratory birds.
- DFW will engage NJ Audubon Society (NJAS), National Audubon chapters in NJ, NJCF, TNC, and Citizen Scientists to act as advocates and monitors on behalf of local IBAs.
- DFW will continue collaboration with state wildlife agencies, the International Wader Studies Group, the Royal Ontario Museum, the US Fish and Wildlife Service, and the Canadian Wildlife Service to carry out shorebird research and surveys on the Delaware Bay, Arctic breeding grounds, and South American wintering grounds.
- DFW will continue collaboration with state wildlife agencies, Partners in Flight, and other regional and national organizations to protect and enhance stopover habitat vital to regional and global bird populations.
- DFW will collaborate with the US Fish and Wildlife Service and the Atlantic Flyway Council to conduct the Mid-Winter Waterfowl and Breeding Waterfowl Surveys.
- DFW will collaborate with the US Fish and Wildlife Service, Atlantic Coast Joint Venture, and universities to identify key staging areas for waterfowl.

d. Monitoring Success

- Compare new survey results to previous surveys to assess trends in abundance, distribution, and habitat use.

5. Freshwater Riparian and Aquatic Species

Currently, the ENSP has developed critical wildlife habitat mapping that identifies important upland, wetland and grassland areas statewide. The next phase of the Landscape Project is the Riparian Landscape Project, which will develop the riparian component of critical habitat mapping to protect species that are not well represented in existing habitat layers. The Bureau of Freshwater Fisheries current work on stream classifications through an integrated biotic index they are performing will provide valuable data for developing the riparian mapping. Freshwater mussels, nongame fishes and Odonata (dragonflies and damselflies) are obligate aquatic species (“that breed exclusively in aquatic habitat (and occur in New Jersey’s rivers, streams, lakes and ponds. Water quality degradation, habitat loss and/or alteration and loss of essential riparian areas threaten species within these groups.

Freshwater Mussels

a. Conservation Goals

- Protect freshwater mussel species through long-term monitoring, stream classification upgrades and the development of management plans. (*Protect habitat – mussels*)

b. Conservation Strategies

- Conduct statewide surveys in previously unsurveyed historic locations and suitable habitats.
- Monitor populations of priority species and develop management plans that would include stream bank restoration and possible relocation efforts into previously occupied, suitable areas.
- Incorporate occurrence information into Riparian Landscape Project, develop species’ models, and identify critical areas.
- Seek Category One upgrades for stream segments with endangered or threatened freshwater mussel species present.
- Gather existing data and combine with survey results to produce a freshwater mussel atlas. The atlas/field guide would also provide species profiles, color plates, and a key to New Jersey species and range maps. Distribute field guide to water watch groups, state agencies, academic institutions, environmental commissions, and other interested parties to assist in locating mussel species throughout the state.

c. Potential Partnerships to Deliver Conservation

- DFW will work with the DEP’s Bureau of Water Monitoring and Standards to recommend stream classification upgrades in areas where listed mussels occur.
- DFW will work with adjacent states to incorporate New Jersey data with existing neighboring states’ data and provide contiguous range maps of critical habitats across state boundaries.
- DFW will work with private landowners, government agencies and non-government organizations (NGOs) and conservation organizations to protect riparian areas through stream bank restoration efforts and land management practices.
- DFW will work with the US Fish and Wildlife Service to protect and restore dwarf wedgemussel populations.

d. Monitoring Success

- Regularly review the population status of priority freshwater mussel species to evaluate trends and re-evaluate official status designations.

Nongame Fish Species

a. Conservation Goals

- Determine species status for unregulated fishes using the Delphi Status Review and revise New Jersey nongame wildlife lists (Act, N.J.S.A. 23:2A-1 et. seq; N.J.A.C. 7:25-4.17) through state rulemaking process to include endangered and threatened species. (*Status – fish*)
- Protect listed freshwater species through identification of critical areas, stream classification upgrades, and/or development of management plans with the NJ Department of Environmental Protection, Division of Fish and Wildlife’s Bureau of Freshwater Fisheries (BFF) that include long-term monitoring. (*Protect habitat – fish*)
- Incorporate occurrence information into the Riparian Landscape Project, develop species models and identify critical areas. (*Monitor wildlife - fish*)

b. Conservation Strategies

- Seek Category One upgrades for stream segments where endangered or threatened species sensitive to water quality occur.
- DFW will determine species status of nongame fish through Delphi Status Review.
- DFW will support shortnose sturgeon research in the Delaware River, including studies to determine critical areas for early life stages.
- DFW will develop management plans for listed species and where appropriate, recommend stream classification upgrades.

c. Potential Partnerships to Deliver Conservation

- DFW will work with DEP’s Bureau of Water Monitoring and Standards to recommend stream classification upgrades in areas where listed fish occur.
- DFW will enlist the assistance of species experts to assess species status for regulatory and recovery purposes.

d. Monitoring Success

- Regularly review the population abundance, productivity and distribution of priority species to evaluate trends and re-evaluate official status designations and monitor recovery efforts.

Odonata (Dragonflies and Damselflies)

a. Conservation Goals

- Protect listed Odonata through long-term monitoring, stream classification upgrades, and development of management plans. (*Enhance habitat – odonata*)

b. Conservation Strategies

- Proceed with state rulemaking process to list Odonata based on results of the Delphi Status Review and Endangered and Nongame Species Advisory Committee recommendations.
- Conduct statewide surveys for all life stages in previously unsurveyed historic locations and suitable habitats.
- Incorporate occurrence information into the Riparian Landscape Project, develop species models and identify critical areas.
- Monitor priority species and develop management plans.
- Seek Category One upgrades for stream segments with endangered or threatened Odonata species present.

c. Potential Partnerships to Deliver Conservation

- DFW will work with DEP's Bureau of Water Monitoring and Standards to recommend stream classification upgrades in areas where the larval stage of listed Odonata occur.
- DFW will work with private landowners, government agencies and non-government organizations such as NJ Audubon Society (NJAS), NJ Conservation Foundation (NJCF), and The Nature Conservancy-NJ Chapter (TNC) to protect riparian areas through stream bank restoration efforts and land management practices.

c. Monitoring Success

- Regularly review the population status of priority Odonata species to evaluate trends and re-evaluate official status designations.

6. Game Species of Regional Priority and Concern

The Division of Fish and Wildlife's Bureau of Wildlife Management is responsible for the development and maintenance of a productive, diversified wildlife resource and the habitat on which that resource depends. This mandate is accomplished through a variety of scientifically sound management and research programs and provides wildlife related recreational opportunities for the citizens of New Jersey. In this strategy, game species of regional priority and game species of concern have been identified within wildlife Table W7 and Table W9, respectively, in Appendix I.

a. Conservation Goals

- Restore declining populations of game species to viable levels. (*Conserve wildlife – game species*)
- Maintain sustainable populations of all current game species of conservation concern in New Jersey. (*Conserve wildlife – game species*)

b. Conservation Strategies

- Monitor population vital rates, identify limiting factors, and adapt management to maintain game species at desired levels.
- Maintain populations of game species at levels that complement viable functioning ecosystems.
- Monitor population vital rates, identify limiting factors, and adapt management to maintain river otters at desired levels.
- Promote habitat conservation to meet the habitat requirements of river otters.

- Investigate using water quality, fish, and *Odonata* occurrence and habitat attributes as correlates to river otter occurrence.

c. Potential Partnerships to Deliver Conservation

- Develop best management practices (BMP) for game species habitats in partnership with the US Fish and Wildlife Service, US Department of Agriculture-Natural Resources Conservation Service, universities, conservation organizations (e.g., Ducks Unlimited, Ruffed Grouse Society, NJ Audubon Society), state and county mosquito commissions, regional wildlife planning groups, and private consultants. Ensure that BMPs reflect a holistic approach that accounts for the needs of all wildlife sharing the same habitat and maintains ecological and community integrity.
- Maintain a corps of Wildlife Conservation Corps volunteers that assist in game species monitoring programs.
- Identify significant habitats for game wildlife of conservation need on public and conservation lands and coordinate with land managers to enhance habitats that maintain ecological integrity.
- Identify significant habitats on private lands (particularly those adjacent to public and conservation lands) and work with landowners to promote management beneficial to regional priority game species without negatively affecting endangered, threatened, or special concern species and their habitats.
- Work with DEP's Bureau of Water Monitoring and Standards to recommend stream classification upgrades in areas where river otters occur.
- Identify significant habitats for river otters on public and conservation lands and coordinate with land managers to enhance habitats.
- Work with fur-trapping organizations to obtain otter carcasses for population monitoring purposes.

d. Monitoring Success

- Regularly review the population status and trends of game species and adjust hunting and trapping regulations as necessary.
- Evaluate how populations of game species of conservation concern respond to habitat management programs and incorporate findings into future habitat management decisions.

e. Information Gaps

- Evaluate and improve monitoring programs for enigmatic (elusive) game species.

7. Long-term Population Monitoring

a. Conservation Goals

- Document distribution, relative abundance, and population trends of wildlife of conservation concern through statewide surveys, atlases, and monitoring programs conducted by professionals and non-professional citizen scientists. (*Monitor wildlife – long-term monitoring*)

b. Conservation Strategies.

- Maintain monitoring programs that collect data on species, suites of species and habitats statewide, including but not limited to the following:
 - Breeding Bird Atlas
 - Breeding Bird Survey
 - Delaware Bay Migratory Shorebird Survey
 - Bald Eagle Midwinter Survey
 - Herptile Atlas
 - Calling Amphibian Monitoring Program
 - Fish Monitoring-Streams and Ponds
 - Freshwater Mussel Atlas
 - Mid-Winter Waterfowl Survey
 - Atlantic Flyway Breeding Waterfowl Survey
 - DFW Bobwhite Call-Count Survey
 - Woodcock Call-Count Survey
 - DFW Beaver-Otter Survey
 - Migratory Game Bird Banding Programs
- Complete and implement the Coordinated Bird Monitoring Plan to increase efficiency and effectiveness of bird surveys.

c. Potential Partnerships to Deliver Conservation

- DFW will work with national coordinators at the US Geological Survey (USGS) to maintain adequate Breeding Bird Survey (BBS) and Calling Amphibian Monitoring Program (CAMP) survey routes in New Jersey to track trends.
- DFW will continue to work with NJ Audubon Society to support and improve the BBS.
- DFW and research-based conservation organizations will train volunteers to be knowledgeable in species identification, survey methodologies and data recording.
- DFW will work with universities, local naturalists and other state agencies to incorporate all available data into centralized databases (primarily Biotics).
- DFW will continue partnership with NJAS and the Citizen Scientist Program to recruit skilled volunteers and carry out bird surveys.
- DFW will develop a plan with the USGS-Bird Banding Lab for monitoring bird populations using bird banding on a broad scale.
- DFW will work with adjacent states to incorporate New Jersey data with existing neighboring states' data and provide contiguous range maps of critical habitats across state boundaries.
- DFW will continue to work with other wildlife agencies, Partners in Flight, and other organizations to coordinate and collaborate on the monitoring of birds at a regional and, eventually, continental scale.
- Work with the USFWS, USGS, and Atlantic Flyway Council to complete surveys and banding for migratory game birds of conservation concern.

d. Monitoring Success

- Evaluate trends of long-term monitoring for suitable species and suites of species and evaluate the power of methodologies to achieve certainty levels. Apply databases to Landscape Project mapping to evaluate trends in distribution relative to habitat trends.

8. Review of Comprehensive Wildlife Conservation Strategy

The Comprehensive Wildlife Conservation Strategy (CWCS) was developed by the NJ Department of Environmental Protection, Division of Fish and Wildlife (DFW) with assistance from numerous organizations (Appendix V). Participation in the development of the CWCS by large, member-based organizations such as NJ Audubon Society, the Nature Conservancy-NJ Chapter, and Ducks Unlimited, representing their constituencies throughout NJ, provided an additional approach to incorporating the needs and concerns of NJ's citizens. In addition, many natural resource management-focus and planning organizations, such as watershed groups, riverkeepers, Pinelands Commission, the National Park Service, and many others, helped coordinate goals and strategies to ensure that the CWCS includes the needs of various organizations focused on more localized conservation efforts. Through a series of meetings, the CWCS has emerged as a truly truly inclusive and comprehensive strategy focused on the long-term viability of NJ's rare wildlife and ecological communities.

a. Conservation Goals

- Comprehensive Wildlife Conservation Strategy (CWCS) is an on-going, dynamic document, to be reviewed every five years. (*Evaluate progress – CWCS*)

b. Conservation Strategies.

- The most current version of the CWCS will be continually available for review on the DFW Website with an open invitation to submit comments.
- At least one regular meeting of the Endangered and Nongame Species Advisory Committee (ENSAC) will be dedicated annually to reviewing progress and soliciting input on the CWCS.
- Every five years, the Division of Fish and Wildlife's Endangered and Nongame Species Program will initiate review of the CWCS beginning with Division and Department biologists who actively research and survey species of conservation concern and their habitats. After review by the Endangered and Nongame Species Advisory Committee, the draft revision will be approved within DEP then posted on the website for public review. A wildlife summit will be held to review the successes and failure, and devise improvements to be built into the revision.
- Each revised CWCS will be linked to the most current Landscape Project mapping and made available for interactive use.
- Each revised CWCS will include a revised listing of species of conservation concern, referencing the state lists of endangered, threatened and special concern wildlife, and those species recognized as high priority by regional conservation plans.

c. Potential Partnerships to Deliver Conservation

- DFW will host a Wildlife Summit every five years with statewide conservation and environmental organizations, federal, state, and local governments, and environmentally based academia to review successes and failures of CWCS and develop additional conservation goals.

1
2 **d. Monitoring Success**

- 3 • The level of participation in the regular Summit events, in which all partners will have
4 opportunities to evaluate and revise the CWCS, may measure success of the Strategy
5 review process.
6
7

G. The Basis of the Comprehensive Wildlife Conservation Strategy and How to Use It

The basis of the Comprehensive Wildlife Conservation Strategy for Wildlife of Greatest Conservation Need and how to use it:

1. All locations were based on the following databases: Biotics; Landscape Map; NJ Audubon Society's Breeding Bird Atlas; the Endangered and Nongame Species Program's Herptile Atlas and Neotropical Landbird Surveys; the Division of Fish and Wildlife, Bureau of Wildlife Management's waterfowl and upland game bird surveys; and the Department of Environmental Protection, Office of Land Management, Natural Heritage Program and NatureServe Conservation Status Assessment.
2. The strategy was constructed for the benefit of users. It is linked to the Landscape Map by the attribute table so users can access the appropriate section of the Comprehensive Wildlife Conservation Strategy (CWCS) for a specific site/area. The CWCS's sections prescribe conservation actions for that area. It will also be available in its entirety on the Department of Environmental Protection, Division of Fish and Wildlife's website, www.njfishandwildlife.com.
3. The strategy develops priorities at all scales from statewide, to Landscape Regions (Region), to Conservation Zones (Zone) within a Landscape Region. At the state level, the strategy prescribes goals and strategies that apply to all areas. At the Landscape level we propose priorities that apply throughout each distinct Landscape Region, while goals and conservation actions are prescribed at the Conservation Zone level.
4. The strategy addresses New Jersey's non-harvested endangered, threatened and declining species as well as species of regional priority with seasonal harvests. The Division of Fish and Wildlife is currently pursuing explicit landscape mapping of game species and a comprehensive plan for all game species. Plans for cold-water and warm-water game fish already exist.
5. All species that occur within each Landscape Region and Conservation Zone are presented in tables within the *Wildlife of Greatest Conservation Need* sections of each Region and Zone. From these lists we have selected a subset of species as the feature species of that zone and have proposed actions to protect them. In addition, the NJ Division of Fish and Wildlife, Endangered and Nongame Species Program (ENSP) recognizes and addresses species for which there is currently no data but strong implications of their presence and use of the habitat(s) (i.e. forest-dwelling bats using habitat surrounding known roost sites).
6. The strategy incorporates the priorities of all national plans including: Partners in Flight North American Landbird Conservation Plan (Mid-Atlantic, Piedmont, and Southern New England regions) The U.S. Shorebird Conservation Plan; Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan (Mid-Atlantic/New England Maritime); North American Waterfowl Management Plan; Northeast American

Woodcock Management Plan; U.S. Fish and Wildlife list of species of conservation concern (2002); Partners in Amphibian and Reptile Conservation; and U.S. Fish and Wildlife Service Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. In addition, nongame species not well-represented among national or regional plans, nor through New Jersey's Delphi Status Review that are identified with state element ranks S1-S3 and/ or global element ranks G1-G3 through NatureServe Conservation Status Assessment (Appendix I) have been incorporated.

7. A number of species and species suites exist that are not understood well enough to develop Regional priorities or Zone goals and actions. Actions for these species are proposed at the state level only.
8. This strategy is constructed to provide a framework for the recovery of endangered, threatened and rare wildlife species, and to maintain the integrity of ecological communities. Targets for each species were chosen at the Region and Zone levels and included maintaining, increasing or restoring/researching populations within a Region or Zone.
9. It will be necessary for the staff of DEP's Division of Fish and Wildlife to negotiate the recommended conservation actions identified within the CWCS for a particular site's management plan. This may involve more interests than those covered in the CWCS. However, when used in conjunction with the Landscape Map and the *Endangered and Threatened Wildlife of New Jersey* book, the CWCS makes a clear statement of the needs for these species, thus providing a useful proactive measure to help avoid user conflicts with regards to rare wildlife.

II. Landscape Assessments and Conservation Strategies

Atlantic Coastal Landscape

Contents of the Chapter on the Atlantic Coastal Landscape

- A. *Ecological Units in the Atlantic Coastal Landscape*
- B. *Geology and Climate*
- C. *Habitats and Priority Conservation Areas*
- D. *Wildlife of Greatest Conservation Need*
- E. *Threats to Wildlife and Habitats of the Atlantic Coastal Landscape Region*
- F. *Priority Conservation Areas, Assessments, and Strategies*
 1. *Atlantic Coastal Cape May*
 - a. *Habitats*
 - b. *Wildlife of Greatest Conservation Need*
 - c. *Threats to Wildlife and Associated Habitats*
 - d. *Conservation Goals*
 - e. *Conservation Actions*
 - f. *Potential Partnerships to Deliver Conservation*
 - g. *Monitoring Success*
 2. *Atlantic City Area*
 3. *Brigantine - Great Bay*
 4. *Barnegat Bay - Little Egg Harbor*
 5. *Northern Atlantic Coastal*
 6. *The Atlantic Ocean*

The Atlantic Coastal landscape consists of barrier islands and beaches, tidal salt marshes, rivers, shallow bays and lagoons along New Jersey's coastline. The landscape includes the eastern edge of Monmouth, Ocean, Atlantic, and Cape May counties, and the Atlantic Ocean. Excluding the ocean, the landscape covers 40,366 hectares (155.8 sq. miles).

A. Ecological Units in the Atlantic Coastal Landscape

The Atlantic Coastal Landscape is within the New Jersey Outer Coastal Plain (232Ab) in the Middle Atlantic Coastal Plain Section.

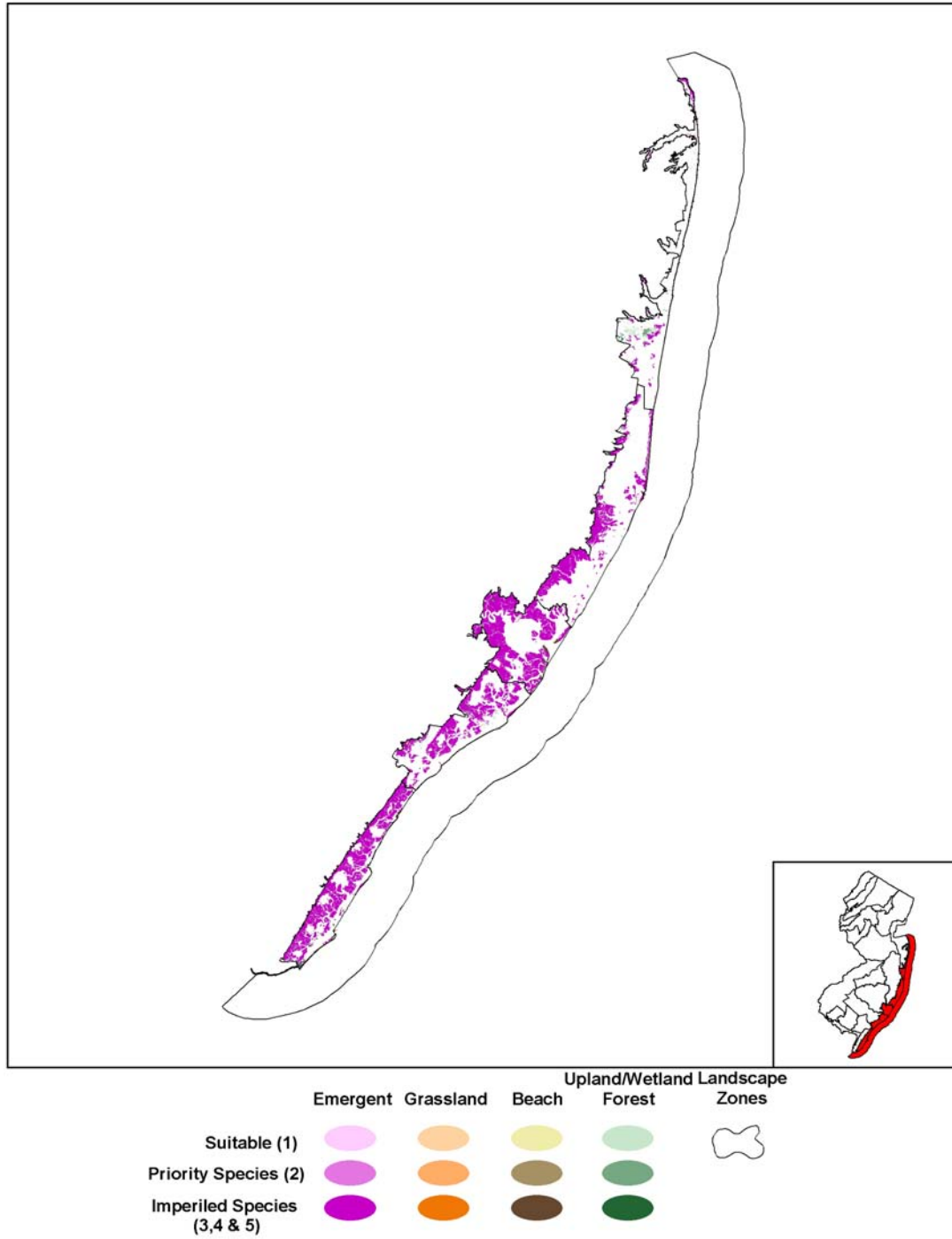
B. Geology and Climate

The Atlantic Coastal Landscape is within the Coastal Plain physiographic province. The landscape's dynamic barrier islands are reformed by erosion and deposition of beach sand by waves and currents, while rivers deposit mud and sand in the bays and estuaries that support the extensive tidal salt marshes. The Atlantic Coastal landscape spans the entire eastern edge of the New Jersey Outer Coastal Plain, where the average temperature varies from 10.5 to 12.2°C (51 to 54°F) with a growing season of 180 to 225 days, and the average annual precipitation is between 101-117 centimeters (39.6 to 46 inches).

C. Habitats of the Atlantic Coastal Landscape

Beaches, dunes, tidal salt marshes, brackish bays, river estuaries, barrier islands, and the ocean characterize the Atlantic Coastal landscape (Figure 4). The heavily developed barrier islands have vast beaches and dunes (1,346 hectares, 5.1 sq. mi.), fragmented upland forest, including scrub-shrub (2,515 hectares, 9.7 sq. mi.), and grasslands (121 hectares, 0.4 sq. mi.). The salt

1 **Figure 4.** Critical landscape habitats within the Coastal Landscape and associated conservation
 2 zones as identified through the Landscape Map (v2).



marshes (36,384 hectares, 140 sq. mi.) and back bays persist in the shadow of beachfront resorts. The Holgate and Little Beach units of Forsythe National Wildlife Refuge, as well as portions of Island Beach State Park and the Sandy Hook Unit of Gateway National Recreation Area, provide examples of how the barrier islands looked before development, with an extensive primary and secondary dune system and maritime scrub-shrub and forest communities. It is important to note that habitats identified as “forest” and “forested wetlands” habitats on the Landscape Maps include scrub/shrub habitat. The landscape is the eastern edge of the Atlantic Flyway and provides important habitat for migrating and breeding birds, as well as for wintering waterfowl and seabirds. The Atlantic Ocean supports New Jersey’s marine wildlife, including fish, turtles, whales, seals, dolphins, and pelagic bird species.

The Priority Conservation Zones in the Atlantic Coastal Landscape are:

- (1) *Atlantic Coastal Cape May*
- (2) *Atlantic City Area*
- (3) *Brigantine - Great Bay*
- (4) *Barnegat Bay - Little Egg Harbor*
- (5) *Northern Atlantic Coastal*
- (6) *The Atlantic Ocean*

Priority conservation zones were delineated based loosely on watershed management area boundaries and sub-watershed area boundaries, grouped or adjusted to incorporate geographic and geological features and to accommodate significant conserved land boundaries. Similarities in the degree of development and the aerial extent of inland watershed drainage also influenced the grouping of the watershed areas.

The Atlantic Coastal Cape May conservation zone includes the entire Atlantic coastal portion of the Cape May watershed management area, except that only the barrier beach and dune areas are included south of the Cape May Canal. The Atlantic City Area conservation zone includes nearly the entire Atlantic coastal portion of the Great Egg Harbor River watershed management area adjusted to exclude lands administered as part of the Forsythe National Wildlife Refuge. The Brigantine - Great Bay conservation zone includes the entire Atlantic Coastal portion of the Mullica watershed management area. In addition, the southernmost sub-watershed area of the Barnegat Bay watershed management area was included to capture all of the lands administered as part of the Forsythe National Wildlife Refuge and all of the lands included in the Great Bay Wildlife Management Area. The Barnegat Bay – Little Egg Harbor conservation zone is comprised of all of the Barnegat Bay watershed management area except the portion included in the Brigantine – Great Bay zone as noted above and excluding the northernmost sub-watershed area (Barnegat Bay – north). The Northern Atlantic Coastal conservation zone includes the entire Atlantic coastal portion of the Monmouth watershed management area plus the Barnegat Bay – north sub-watershed as noted above. Finally, the Atlantic Ocean conservation zone includes all of the open ocean areas bordering the Atlantic Coastal Landscape extending out to the 3-mile limit under state jurisdiction.

D. Wildlife of Greatest Conservation Need of the Atlantic Coastal Landscape

Successful management of the Atlantic Coastal Landscape species and habitats is essential to the conservation in New Jersey of beach nesting birds, colonial waterbirds (except great blue herons), ospreys, marine mammals, pelagic birds, and Atlantic sturgeon. It also provides critical wintering and migratory habitat for a variety of waterfowl including the world's largest concentration of wintering Atlantic brant and American black ducks. The Atlantic Coastal Landscape also plays a crucial role in the conservation of Northern diamondback terrapin, peregrine falcons, northern harriers, black rails, Northeastern beach tiger beetles, migratory shorebirds, migratory songbirds, and coastal marsh birds. In addition, this landscape plays an accessory role in the conservation of Cope's gray treefrogs, Fowler's toads, eastern box turtles, forest-dwelling bats, pied-billed grebes, and bald eagles.

The Atlantic Coastal Landscape of New Jersey supports 17 federal endangered or threatened species including bald eagle, piping plover, northeastern beach tiger beetle, and whales and sea turtles associated with New Jersey's coast. This landscape also supports nine state endangered species, five state threatened species, and 52 species of special concern or regional priority. Several game species, most notably selected waterfowl species, have been assigned priority status. The state endangered species are the American bittern, black skimmer, least tern, northern harrier, peregrine falcon, pied-billed grebe, sedge wren, short-eared owl, and Cope's gray treefrog. Black rail, black- and yellow-crowned night herons, red knot and osprey are the state threatened species. The American oystercatcher, common tern, little blue heron, red-throated loon, ruddy turnstone, eastern box turtle, and northern diamondback terrapin are among the state species of special concern and regional priority. The beaches and dunes are nesting habitat for black skimmers, least terns, piping plovers, and other beach nesting birds. The beach is also habitat for the proposed reintroduction of the northeastern beach tiger beetle. Red knot and other migratory shorebirds, as well as songbirds, raptors, and butterflies, stop in the Atlantic Coast Landscape during migration. Bald eagles, ospreys, and peregrine falcons, coastal marsh birds, waterfowl, and colonial waterbirds nest and forage in the salt marshes and meadows. Northern diamondback terrapins can be found in the tidal marshes, while raptors and Cope's gray treefrogs inhabit upland forested wetlands. The region's forests and riparian areas also host summer and migratory populations of forest-dwelling bats and may contain habitat suitable for summer colonies of Indiana bats. Harbor seals, harbor porpoises, whales, sea turtles, pelagic birds and waterfowl, and anadromous fish species inhabit the Atlantic Ocean and coastal bays.

The following tables list the wildlife of greatest conservation need, the suites of wildlife, and the conservation opportunity areas to conserve them in the Atlantic Coastal Landscape. The wildlife are prioritized by federal endangered and threatened, state endangered, state threatened, and special concern and regional priority status.

Prioritized List of the Wildlife of Greatest Conservation Need and their Location in the Atlantic Coastal Landscape

Table C1. Federal Endangered and Threatened Species*

Common Name	Federal Status & Regional Priority	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Mammals							
Blue whale	E						I
Fin whale	E						I
Humpback whale	E						I
Indiana bat	R	R**	R**	R**	R**	R**	
Right whale	E						I
Sei whale	E						I
Sperm whale	E						I
Birds							
Bald eagle	T		M	M	M	M	
Piping plover	T & RP	I	I	I	I	I	
Roseate tern	E/T & RP				R		
Reptiles							
Bog turtle	T				R		
Green sea turtle	E/T	I	I	I	I	I	I
Hawksbill sea turtle	E	I	I	I	I	I	I
Kemp's ridley sea turtle	E	I	I	I	I	I	I
Leatherback sea turtle	E	I	I	I	I	I	I
Loggerhead sea turtle	T	I	I	I	I	I	I
Insects							
Northeastern beach tiger beetle	T			I	R	I	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife.

**Potential presence.

T: Federally threatened species.

E: Federally endangered species.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table C2. State Endangered Species

Common Name	Regional Priority	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Birds							
American bittern	RP	R	R	R	R	R	
Black skimmer	RP	I	I	I	I	M	
Least tern	RP	I	M	I	I	I	
Northern harrier		I	I	I	I	M	
Peregrine falcon		M	M	M	M	I	
Pied-billed grebe	RP			I	I		
Sedge wren	RP	M	M	M	M		
Short-eared owl	RP	I	I	I	I		
Amphibians							
Cope's gray treefrog		M		M	M		

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table C3. State Threatened Species

Common Name	Regional Priority	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Birds							
Black rail	RP	I	I	I	I		
Black-crowned night-heron	RP	I	I	I	I	I	
Osprey		M	M	M	M	M	
Red knot	RP	I	I	I	I	I	
Yellow-crowned night-heron	RP	I	I	I	I	I	

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table C4. Nongame Species of Conservation Concern

Common Name	Conservation Status	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Mammals							
Harbor porpoise	RP	M	M	M	M	M	M
Harbor seal	RP	M	M	M	M	M	M
Marsh rice rat	RP	R	R	R	R	R	
Southern bog lemming	RP	R	R	R	R	R	
Birds							
American golden-plover	RP	M	M	M	M	M	
American oystercatcher	RP	I	I	I	I	I	
Audubon's shearwater	RP						M
Black tern	SC/RP	M	M	M	M	M	
Bridled tern	RP						M
Caspian tern	SC	M	M	M	M	M	
Cattle egret	RP	I	I	I	I	I	
Chimney swift	RP	I	I	I	I	I	
Common barn owl	SC	M	M	M	M	M	
Common tern	SC/RP	I	I	I	I	I	
Forster's tern	RP	M	M	M	M		
Glossy ibis	RP	I	I	I	I	I	
Great blue heron	SC/RP	M	M	M	M	M	
Great crested flycatcher	RP	M	M	M	M	M	
Great egret	RP	M	M	M	M	M	
Greater shearwater	RP						M
Greater yellowlegs	RP	M	M	M	M	M	
Green heron	RP	M	M	M	M	M	
Gull-billed tern	RP	I	I	I	I	I	
Horned grebe	RP						M
Horned lark	SC	M	M	M	M	M	
Hudsonian godwit	RP	M	M	M	M	M	
King rail	SC/RP	M	M	M	M		
Least bittern	SC/RP	R	R	R	R	R	
Little blue heron	SC/RP	I	I	I	I	I	
Manx shearwater	RP						M
Marbled godwit	RP	M	M	M	M	M	
Marsh wren	RP	M	M	M	M	M	
Nelson's sharp-tailed sparrow	RP	M	M	M	M	M	
Northern gannet	RP						M
Purple sandpiper	RP	M	M	M	M	M	

Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Birds (continued)							
Razorbill	RP						M
Red-throated loon	RP						M
Royal tern	RP	M	M	M	M	M	
Ruddy turnstone	RP	I	I	I	I	I	
Saltmarsh sharp-tailed sparrow	RP	I	I	I	I	I	
Sanderling	SC/RP	M	M	M	M	M	
Seaside sparrow	RP	M	M	M	M	M	
Semipalmated sandpiper	RP	I	I	I	I	I	
Snowy egret	SC/RP	I	I	I	I	I	
Tricolored heron	SC/RP	I	I	I	I	I	
Whimbrel	SC/RP	M	M	M	M	M	
Willet	RP	M	M	M	M	M	
Wilson's phalarope	RP	M	M	M	M	M	
Reptiles							
Eastern box turtle	SC	M	M	M	M		
Northern diamondback terrapin	SC	I	I	I	I	I	
Amphibians							
Fowler's toad	SC	M	M	M	M	M	
Fish							
Atlantic sturgeon	SC*/RP	R	R	R	R	R	R

* Federal species of special concern

SC: Species of special concern as identified within the state.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table C5. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Regional Priority	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Birds							
American black duck	RP	M	M	M	M	M	
Atlantic brant	RP	M	M	M	M	M	
Black scoter	RP	R	R	R	R	R	R
Bufflehead	RP	M	M	M	M	M	
Canada goose (Atlantic population)	RP	M	M	M	M	M	
Canvasback	RP	I	I	I	I	I	
Clapper rail	RP	M	M	M	M	M	
Common eider *	RP	R	R	R	R	R	R
Greater scaup	RP	I	I	I	I	I	
Harlequin duck*	RP	R	R	R	R	R	R
Lesser scaup	RP	I	I	I	I	I	
Long-tailed duck	RP	R	R	R	R	R	R
Northern pintail	RP	I	I	I	I	I	
Surf scoter	RP	R	R	R	R	R	R
Virginia rail	RP	R	R	R	R	R	
White-winged scoter	RP	R	R	R	R	R	R

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jettys each winter, but this is insignificant to the overall population status.

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table C6. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Regional Priority	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Fish							
Hickory shad		X	X	X	X	X	X

X: Species present. Management strategy not yet determined.

Table C7. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Regional Priority	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Mammals							
River otter		M	M	M	M	M	
Birds							
Sora rail		R	R	R	R	R	

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table C8. Suites of Wildlife and their Location in the Atlantic Coastal Landscape

Common Name	Atlantic Coastal Cape May	Atlantic City Area	Brigantine - Great Bay	Barnegat Bay - Little Egg Harbor	Northern Atlantic Coastal	Atlantic Ocean
Mammals						
Forest-Dwelling Bats	X	X*	X*	X*	X*	
Mammal inhabitants of Wetland, Marsh and Bog	X	X	X	X	X	
Pinnipeds	X	X	X	X	X	X
Whales						X
Birds						
Beach Nesting Birds	X	X	X	X	X	
Coastal High marsh Birds	X	X	X	X	X	
Coastal Low-Marsh Birds	X	X	X	X	X	
Colonial Waterbirds	X	X	X	X	X	
Migratory Shorebirds	X	X	X	X	X	
Migratory Songbirds & Raptors	X	X	X	X	X	
Pelagic and Seasonally Pelagic Birds	X	X	X	X	X	X
Waterfowl	X	X	X	X	X	X
Reptiles						
Reptiles of Special Concern	X	X	X	X	X	
Sea Turtles	X	X	X	X	X	X
Amphibians						
Amphibians of Special Concern	X		X	X		
Fish						
Anadromous	X	X	X	X	X	X
Insects						
Northeastern beach tiger beetle**			X	X	X	

*Potential presence

** Federally listed, proposed reintroduction

X: Species suite occurs within identified landscape region.

E. Threats to Wildlife and Habitats of the Atlantic Coastal Landscape

The barrier islands of New Jersey's coastal landscape are heavily influenced by human alteration. Efforts to stabilize barrier islands, including jetties, groins, bulkheads, beach replenishment projects, and intense dune management (including excessive dune fencing and unnecessary beach grass planting where adequate storm protection already exists), interfere with the natural geological processes needed to create and maintain habitat for beach strand species. While most developable land in the coastal landscape has been built, continued in-fill development threatens the remaining scrub-shrub and forested habitats important to migratory songbirds, raptors, and butterflies. This development also creates barriers for movement for amphibians and reptiles such as the northern diamondback terrapin and increases disturbance to important foraging and nesting habitats for beach nesting birds and colonial waterbirds. Salt marshes and other coastal wetland habitat has been destroyed or severely altered as a result of coastal development and management to control mosquitoes and/or tidal flow, resulting in negative or unknown effects on native species. Mechanical beach raking reduces foraging habitat for beach nesting birds and migratory shorebirds and destroys breeding habitat for northeastern beach tiger beetles.

Barrier beaches and back bay waters are meccas for human recreational activity. The resulting disturbance to nesting and foraging birds leads to diminished nesting success and brood survival for beach nesting birds, colonial waterbirds, osprey, and others. Vehicle use on beaches, including permitted private and "official" vehicles, creates disturbance, harms foraging habitats, can destroy habitats for northeastern beach tiger beetles, and can cause direct mortality for beach nesting birds. Boating and personal watercraft activity inflicts disturbance on nesting and foraging colonial waterbirds, osprey and others.

Many commercial shipping and fishing enterprises cause direct mortality to whales, sea turtles, and other marine species. Low to mid-frequency active sonar, along with other anthropogenic (human generated) sound sources, threatens marine mammals by disrupting navigation, foraging and communication abilities. Overexploitation of riparian, estuarine, and marine fisheries are not only a threat to specific fish species, but may also have ecosystem impacts that are inimical to species such as colonial waterbirds, the bald eagle, osprey, and others. Environmental impacts of aquaculture and back-bay hydraulic crab dredging are largely unmeasured and poorly understood. The effects of offshore and inshore wind energy projects (towers) on avian species, especially songbirds and seabirds, and possibly bats, are unknown but may be a cause of mortality due to collision. Depending on where they are sited, offshore structures associated with wind energy projects may also have impacts on marine mammals and sea turtles.

Human enterprise in the watersheds that feed estuaries has increased pollution from point-sources and run-off into estuarine areas. Contaminants such as PCBs, pesticides and heavy metals pose threats to aquatic species and ecosystems, and impact reproductive success of bald eagles, ospreys, peregrine falcons, waterfowl and water birds. Large oil spills, although only periodic events, are likely to continue to occur because of the state's proximity to major shipping lanes up the Delaware River and into the New York City Harbor. Spills loom as a possible threat to a wide range of coastal species, with potentially catastrophic results.

1 Human activities also negatively affect ecosystems by introducing invasive or exotic plants and
2 animals and sustaining native species whose populations have expanded beyond that which
3 would occur naturally. Invasive and/or exotic plants or wildlife (e.g. phragmites, Japanese
4 sedge, mute swan) diminish habitat suitability of coastal marsh and dune habitats for wildlife,
5 and reduce the ecological integrity of natural communities. Over-abundant native wildlife
6 species (e.g. resident Canada goose, greater snow goose, gull species), if left uncontrolled, also
7 have potentially negative impacts on habitat quality and populations of other critical wildlife.
8 Burgeoning subsidized predator populations, (e.g. red fox, crow species, gull species, raccoon,
9 striped skunk, free roaming “owned” or feral cats), severely impair nesting success and
10 productivity of beach nesting birds, colonial waterbirds and northern diamondback terrapins.

11
12 Although it is difficult to measure, assess, and address the impacts of sea-level rise, this issue
13 presents perhaps the greatest long-term threat to the coastal habitat and its species as it may
14 completely alter the coastal landscape.
15

F. Priority Conservation Areas, Assessments, and Strategies within the Atlantic Coastal Landscape

1. Atlantic Coastal Cape May

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring success*

a. Habitats

The Atlantic Coastal Cape May Zone spans the eastern edge of the Cape May Peninsula, from Cape May to southern Ocean City (Figure 5). An extensive area of salt marsh and relatively small shallow bays, and tidal creeks and lagoons, extends from the uplands along the Garden State Parkway to the dunes and beaches of the narrow and heavily developed Atlantic Coast barrier islands (Wildwoods, Stone Harbor, Avalon, Sea Isle City, and Ocean City). Very few small creeks feed the area from the adjacent mainland uplands.

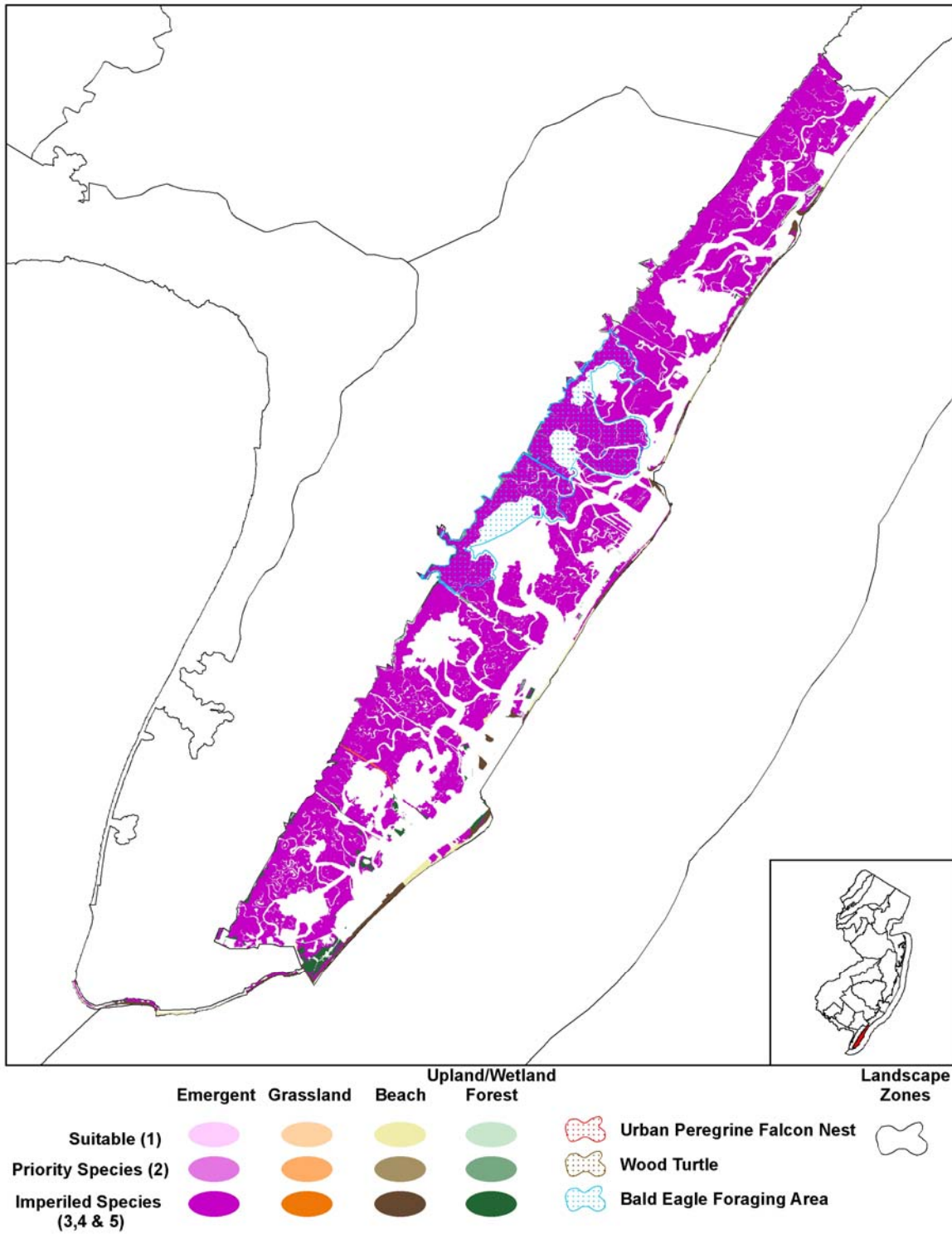
Conservation areas of opportunity in the Atlantic Coastal Cape May Zone include the beach and dunes of Cape May Point State Park, The Nature Conservancy's South Cape May Meadows Beach, the U.S. Coast Guard Training Center (TRACEN) beach, Two-Mile Beach (including the sections of the U.S. Coast Guard Loran Support Unit (LSU) and Cape May National Wildlife Refuge), Cape May Coastal Wetlands WMA, the ever-changing sandy islands and sandbars of Hereford Inlet, Stone Harbor Point (beach and adjacent undeveloped scrub-shrub), Strathmere Natural Area, and Corson's Inlet State Park. Several smaller municipal parks, including the Stone Harbor Bird Sanctuary and Armacost Park (Avalon) provide nesting habitat for colonial waterbirds and stopover habitat for migrating songbirds.

b. Wildlife of Greatest Conservation Need

The Atlantic Coastal Cape May region supports seven federal endangered or threatened species, eight state endangered species, five state threatened species, and 44 species of special concern or regional priority. The federal endangered or threatened species include piping plover, as well as sea turtle species that may enter the region's inlets and bays. In addition, summer or migratory populations of bats, including the federal endangered Indiana bat, are known to occur in the Atlantic Coastal Cape May Zone. American bittern, black skimmer, least tern, northern harrier, peregrine falcon, sedge wren, short-eared owl, and Cope's gray treefrog are state endangered species. Black rail, black-crowned night-heron, osprey, red knot, and yellow-crowned night-heron species are state threatened. Special concern wildlife include the American oystercatcher, common tern, great blue heron, whimbrel, northern diamondback terrapin, and other coastal marsh birds, colonial waterbirds, migratory shorebirds, reptiles, and amphibians. Several game species, most notably selected waterfowl species, have been assigned priority status.

The narrow Cape May Peninsula concentrates birds as they migrate along the Atlantic Coast. The Cape May coastal beaches and dunes provide important habitats for nesting black skimmers, least terns, and piping plovers, and migrating shorebirds, including red knots and whimbrels.

1 **Figure 5.** Critical landscape habitats within the Atlantic Coastal Cape May conservation zone,
2 as identified through the Landscape Map (v2).



The coastal marsh provides nesting and foraging habitat for American oystercatchers, bald eagles, common terns, ospreys, peregrine falcons, northern diamondback terrapins, and coastal marsh birds and colonial waterbirds. Back bay salt marshes and coastal sounds in this area are critical wintering areas for Atlantic brant and American black ducks in the Atlantic Flyway. Other wintering and migratory waterfowl utilize coastal marshes and bays. Small freshwater wetlands immediately adjacent to coastal salt marshes provide habitat for Cope's gray treefrog. Patches of upland forest and scrub-shrub support nesting colonial waterbirds, eastern box turtles, forest-dwelling bats, Cope's gray treefrogs, and Fowler's toads. Marine mammals, sea turtles, and some species of anadromous fish utilize estuarine habitat, including inlets and bays. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Atlantic Coastal Cape May Zone

Table C9. Federal Endangered and Threatened Species*

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Piping plover		X		
Reptiles				
Green sea turtle	X			
Hawksbill sea turtle	X			
Kemp's ridley sea turtle	X			
Leatherback sea turtle	X			
Loggerhead sea turtle	X			

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

X: Species occurs within the identified habitat.

Table C10. State Endangered Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American bittern			X	
Black skimmer		X	X	
Least tern		X		
Northern harrier			X	X
Peregrine falcon			X	
Sedge wren			X	
Short-eared owl			X	X
Amphibians				
Cope's gray treefrog			X	

X: Species occurs within the identified habitat.

Table C11. State Threatened Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
Black rail			X	
Black-crowned night heron			X	X
Osprey		X	X	
Red knot		X	X	
Yellow-crowned night heron			X	X

X: Species occurs within the identified habitat.

1 Table C12. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Harbor porpoise	X			
Harbor seal ♦	X	X		
Marsh rice rat			X	
Southern bog lemming			X	X
Birds				
American golden-plover			X	
American oystercatcher		X	X	
Black tern		X		
Caspian tern		X		
Cattle egret			X	
Chimney swift				X
Common barn owl				X
Common tern		X	X	
Forster's tern			X	
Glossy ibis			X	
Great blue heron				X
Great crested flycatcher				X
Great egret			X	
Greater yellowlegs			X	
Green heron			X	X
Gull-billed tern		X	X	
Horned lark		X		
Hudsonian godwit			X	
King rail			X	
Least bittern			X	
Little blue heron			X	
Marbled godwit			X	
Marsh wren			X	
Nelson's sharp-tailed sparrow			X	
Purple sandpiper		X		
Royal tern		X		
Ruddy turnstone		X	X	
Saltmarsh sharp-tailed sparrow			X	
Sanderling		X	X	
Seaside sparrow			X	
Semipalmated sandpiper		X	X	
Snowy egret			X	
Tricolored heron			X	
Whimbrel			X	
Willet		X	X	
Wilson's phalarope		X	X	
Reptiles				
Eastern box turtle				X
Northern diamondback terrapin		X	X	
Amphibians				
Fowler's toad		X		
Fish				
Atlantic sturgeon	X			

♦ Harbor seal primarily present in water, but utilize beach as "haul-outs".

X: Species occurs within the identified habitat.

Table C13. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American black duck	X		X	
Atlantic brant	X		X	
Black scoter	X			
Bufflehead	X		X	
Canada goose (Atlantic population)	X		X	
Canvasback	X		X	
Clapper rail			X	
Common eider *	X			
Greater scaup	X		X	
Harlequin duck*	X			
Lesser scaup	X		X	
Long-tailed duck	X			
Northern pintail	X		X	
Surf scoter	X			
Virginia rail			X	
White-winged scoter	X			

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jetties each winter, but this is insignificant to the overall population status.

X: Species occurs within the identified habitat.

Table C14. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table C15. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
River otter	X		X	
Birds				
Sora rail			X	

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Habitat loss due to commercial and residential development has historically been one of the greatest threats to wildlife along the coast, including within the Atlantic Coastal Cape May Zone. Although a great deal of the buildable private land within this zone is now developed, critical habitat continues to be lost or altered due to development. Intensive dune management, including overuse of dune fencing and unnecessary beach grass planting (i.e. where adequate storm protection already exists), has reduced habitat quality for beach nesting birds and

continues in some locations, such as Stone Harbor, Sea Isle City, Strathmere village, and Ocean City. Mechanical beach raking on virtually all municipal beaches (with the exception of Stone Harbor Point and Strathmere village) reduces available foraging habitat for piping plovers and migratory shorebirds and poses risks to unfledged piping plover and least tern chicks. Development of the little remaining coastal scrub-shrub and forested habitat reduces habitat critical for migratory songbirds, raptors, and butterflies. Invasive plant species, such as phragmites, which dominate many dredge disposal sites and some coastal salt marshes, reduce the suitability of habitat for critical coastal species, including breeding long-legged wading birds, marsh-nesting birds, and waterfowl. The impacts of aquaculture, particularly for hard clams (*Mercenaria mercenaria*) as well as hydraulic crab dredging, are largely unmeasured and poorly understood.

Threats due to human activity, many of which are related to intense recreational uses of the local beaches and waterways, are also major factors in this zone. Beach nourishment projects create otherwise suitable habitat in areas of high human use, increasing impacts of human disturbance on beach nesting birds. Intensive recreational use of virtually all beaches, with the exceptions of the U.S. Coast Guard – TRACEN and the Two-Mile Beach Unit of the Cape May National Wildlife Refuge, severely impacts nesting success for beach nesting birds and also creates disturbance to a wide range of migrating shorebirds. Lax enforcement of local “no-dogs-on-beach” ordinances on nearly all municipal and some state-owned beaches (e.g. Strathmere Natural Area) creates severe disturbance of beach nesting birds, with resultant impacts on nesting success. Boats and personal watercraft create disturbance at back bay colonial waterbird colonies and osprey nests, especially those located closest to barrier islands, and interfere with foraging throughout the region.

Excessive predation, especially by human subsidized species (e.g. red fox, crow, gull species, raccoon, striped skunk, free-roaming “owned” or feral cats), severely impairs beach nesting bird and colonial waterbirds breeding success. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect critical habitats identified by the Landscape Project.
- Reduce and mitigate the negative effects of beach nourishment projects on beach nesting birds and their habitat.
- Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone.
- Modify local beach management practices to reduce their adverse effects on beach nesting birds.
- Reduce the adverse impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality.
- Continue to monitor and protect osprey and peregrine falcon.
- Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish species in the Atlantic Coastal Cape May Zone.
- Preserve populations of endangered, threatened, and special concern fishes.

- Conduct investigations to improve understanding of habitat needs of critical wildlife species.
- Reduce incremental loss of remaining scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species.
- Identify areas where additional habitat-based regulatory measures or land acquisition would be appropriate to benefit wildlife.
- Pursue habitat restoration or enhancement where it would benefit wildlife.
- Improve marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl.
- Reduce deleterious effects of pesticides on coastal species and ecosystems.
- Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat.
- Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets.
- Protect beach nesting bird sites and associated foraging habitats from human disturbance.
- Reduce the impacts of human disturbance on colonial nesting birds.
- Protect overwintering colonies and/or “haul out” areas for harbor seals.
- Reduce excessive predation on beach nesting birds, colonial waterbirds, and other species.
- Reduce mortality of northern diamondback terrapin.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify critical wildlife habitat to protect or buffer to accommodate sea-level change.
- Develop and promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical beach/dune, coastal scrub-shrub, forest, and wetland habitats and assess their condition for nesting, migrating, and wintering birds, and other coastal species. Maintain information and incorporate all new survey and mapping data into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land use regulation, municipal and regional planning, land acquisition priorities and development of management and conservation strategies. (<i>Protect habitat – Landscape Project</i>)
1°	Develop, review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available, including species or species groups (e.g. waterfowl) not currently integrated. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)

1

Priority	Conservation Actions (continued)
Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone	
1°	Review Comprehensive Management Plan for the Two-Mile Beach Unit of the Cape May NWR to coordinate long-range planning goals and strategies, especially with regards to development of their Habitat Management Plan. (<i>Protect habitat – Landscape Project</i>)
1°	Develop management plans through NJ Division of Parks and Forestry for state parks and natural areas, including Cape May Point State Park, Corson’s Inlet State Park, and Strathmere Natural Area. Ensure that they have a strong beach nesting bird management component. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
Reduce and mitigate negative impacts of beach nourishment for beach nesting birds	
1°	Develop and implement beach management agreements with municipalities. Update existing agreements. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Continue to coordinate with U.S. Army Corps of Engineers (USACE), NJDEP Office of Engineering and Construction (OEC) and Land Use Regulation Program (LURP) to reduce impacts on nesting success of beach nesting birds. (<i>Conserve wildlife – rare wildlife</i>)
1°	Continue to work with USACE to integrate designs into beach nourishment projects that increase availability of and access to nesting and foraging habitat. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate experimental techniques to improve foraging habitat on nourished beaches. (<i>Conserve wildlife – rare wildlife</i>)
Modify local beach management practices to reduce impacts to beach nesting birds	
1°	Work with U.S. Department of Agriculture (USDA) – Natural Resources Conservation Services (NRCS), U.S. Fish and Wildlife Service (USFWS), USACE, and NJDEP LURP to develop best management practices, including dune management policies, to incorporate into beach nesting bird management agreements. (<i>Other practices – land management</i>)
1°	Incorporate limits on beach raking practices into beach nesting bird management agreements. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
Reduce impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality	
1°	Eliminate or reduce phragmites from dredge material sites to allow for the natural succession of woody habitats to benefit nesting long-legged wading birds or create sandy substrate for ground nesting colonial waterbirds at selected sites. “Jump-start” natural vegetation (using nursery stock and seedlings) where appropriate. (<i>Conserve wildlife – rare wildlife, invasives</i>)

2

Priority	Conservation Actions (continued)
1°	Develop and implement best management practices to address adverse effects of both invasive plant or wildlife species (e.g. phragmites, mute swan) and over-abundant native wildlife (e.g. resident Canada geese, greater snow geese) on quality of coastal wetland habitat. (<i>Conserve wildlife – invasives; Other practices – land management</i>)
1°	Assess impacts of gull populations (laughing gull, greater black-back gull, herring gull) on breeding success of beach nesting birds, colonial waterbirds, and other species to determine if integrated wildlife damage management of gulls is necessary. (<i>Conserve wildlife – subsidized predators</i>)
2°	Monitor encroachment of Japanese sedge in beach/dune habitat and assess impacts on habitat quality. Implement control efforts where appropriate. (<i>Evaluate restoration – invasives</i>)
Monitor and protect osprey and peregrine falcon	
1°	Maintain nesting opportunities through repair and replacement of existing man-made structures. Identify where additional nesting structures would be appropriate, such as the coastal meadows between Ocean City and Sea Isle. (<i>Conserve wildlife – rare wildlife</i>)
1°	Continue regular monitoring of all known pairs of peregrine falcons, including assessment of productivity and threats. Track other regularly observed birds to determine new nesting pairs/sites. (<i>Monitor wildlife – long-term monitoring; Conserve Wildlife – rare wildlife</i>)
1°	Continue regular monitoring of osprey, including coast wide survey of population and nesting success on biannual basis, and annual assessment of reproductive success at several targeted locations. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Monitor levels of heavy metals and other contaminants, especially Mercury, in eggs, adults and young, to determine effects on reproductive success. (<i>Conserve wildlife - contaminants</i>)
1°	Continue to monitor fish stocks, in particular menhaden, to determine effects of reduced or changing prey base on reproductive success of osprey. (<i>Monitor wildlife – long-term monitoring</i>)
Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish species	
1°	Continue intensive monitoring of populations and reproductive success of beach nesting birds, including piping plover, least tern, black skimmer, common tern and American oystercatcher. (<i>Monitor wildlife – long-term monitoring; Conserve Wildlife – rare wildlife</i>)
1°	Increase frequency of coast-wide aerial colonial waterbirds' surveys to once every other year to better determine population trends and distribution. Continue critical investigation of aerial survey technique through selected “ground truthing” and literature and peer review in order to increase efficacy of survey, minimize surveyor bias and error, and increase accuracy of trend data. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Determine reproductive success of colonial waterbirds at targeted nesting colonies. Identify factors limiting success, including predators and possible effects of contaminants. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife, contaminants</i>)
1°	Increase understanding of migratory songbird distribution and habitat use by conducting surveys or reviewing existing databases to better identify specific migratory songbird species using coastal habitat, as well as distribution of species. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Conduct surveys to determine distribution, population, and habitat use of coastal marsh birds, in particular high marsh specialists, such as northern harriers, black rails, and salt marsh sharp-tailed sparrows. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Continue the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Protect habitat – migratory birds; Conserve wildlife – game species</i>)
1°	Continue the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – game species</i>)
2°	Continue surveys of wintering population of American oystercatcher. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
2°	Conduct baseline inventory of coastal mammal species, including the marsh rice rat and southern bog lemming. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
Preserve populations of endangered, threatened, and special concern fishes	
1°	Map distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Conserve wildlife – rare wildlife; Protect habitat - fish</i>)
Conduct investigations to improve understanding of habitat needs of critical wildlife species	
1°	Pursue investigations of comparative reproductive success of American oystercatcher and common terns on beach- vs. marsh-nesting habitat at selected sites, including identification of specific threats. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate habitat selection of breeding colonial waterbirds, including use of phragmites. (<i>Protect habitat – Landscape Project</i>)
1°	Research population distribution of northern diamondback terrapin to determine critical areas for protection. (<i>Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring</i>)
1°	Conduct research to quantify importance of shrub-scrub habitat for migratory songbirds. (<i>Protect habitat – migratory birds</i>)
1°	Investigate impacts of aquaculture on waterfowl and other wildlife. (<i>Aquaculture – land management; Conserve wildlife – game species</i>)

1

Priority	Conservation Actions (continued)
1°	Investigate carrying capacity of coastal salt marshes for wintering black ducks. <i>(Conserve wildlife – game species)</i>
1°	Investigate impacts of hydraulic crab dredging on back-bay habitats and wildlife. <i>(Protect habitat – humans)</i>
1°	Investigate home ranges of wintering Atlantic brant in relation to carrying capacity of back bay habitat for Atlantic brant. <i>(Conserve wildlife – game species)</i>
Reduce loss of scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species	
1°	Identify remaining parcels of scrub-shrub habitat and forest patches and protect through either application of Coastal Zone Management (CZM) “critical wildlife habitat” designation or acquisition. <i>(Protect habitat – Landscape Project, migratory birds)</i>
Identify areas where additional habitat-based regulatory protection or land acquisition would be appropriate.	
1°	Identify areas, such as Hereford Inlet, where the creation of a Marine Conservation Zone (e.g. Sedge Islands WMA) would be an appropriate conservation tool and assess the feasibility of implementation. <i>(Protect habitat – Landscape Project; Protect habitat – migratory birds)</i>
1°	Investigate feasibility of incorporating Champagne Island into Cape May Wetlands Wildlife Management Area (WMA). <i>(Protect habitat – Landscape Project)</i>
Pursue habitat restoration or enhancement where it would benefit wildlife	
1°	Create and maintain additional nesting and foraging areas for the piping plover and other beach nesting bird species at Cape May NWR – Two Mile Beach Unit and the South Cape May Meadows beach. Investigate if habitat restoration is appropriate at other beach nesting bird sites, including USCG – TRACEN and USCG – LSU. <i>(Conserve wildlife – rare wildlife)</i>
1°	Reduce state regulatory impediments to improving habitat for beach nesting birds. <i>(Conserve wildlife – rare wildlife)</i>
1°	Monitor habitat changes at Stone Harbor Point to ensure that the former use of the site as a dredge material disposal facility has been adequately mitigated. Identify opportunities for future beach renourishment projects/cycles to enhance nesting habitat at the site. <i>(Conserve wildlife – rare wildlife)</i>
1°	Continue to work with NJDEP-OEC, USACE, and other appropriate agencies to coordinate beneficial placement of dredge materials for creation, enhancement, or maintenance of colonial waterbird nesting, in particular with regards to Intercoastal Waterway restoration projects. Develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife. <i>(Conserve wildlife – rare wildlife; Other practices – land management)</i>
2°	Reestablish or restore submerged aquatic vegetation beds in critical areas where they formerly occurred in order to benefit waterfowl species. <i>(Conserve wildlife – game species)</i>

1

Priority	Conservation Actions (continued)
Improve marsh management techniques to benefit critical wildlife species	
1°	Conduct critical assessment of effects of Open Marsh Water Management on wildlife species, in particular high marsh nesting birds and waterfowl. Modify best management practices as appropriate. (<i>Conserve wildlife – rare wildlife, game species; Other practices – land management</i>)
Reduce deleterious effects of pesticides on coastal species and ecosystems	
1°	Support and conduct investigations assessing the impacts of pesticides and biological controls on coastal species, in particular those species dependent on coastal marshes and wetlands. Modify best management practices as appropriate. (<i>Other practices – land management</i>)
Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat	
1°	Continue to provide information to local, state, and federal agencies involved in emergency oil spill response, including assessments of impacts on critical natural resources during and after spill events. Update guidance documents used by agencies to develop strategies to plan for and reduce impacts of oil spill. (<i>Protect habitat – oil</i>)
Reduce human disturbance to red knot and other migratory shorebirds	
1°	Identify important staging areas, determine and enforce the necessary restrictions on human activities. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans; Corridors – migratory birds</i>)
1°	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites to implement stringent enforcement of endangered species laws including harassment and human disturbance. (<i>Protect habitat – humans</i>)
Protect beach nesting bird sites and foraging habitats from human disturbance	
1°	Continue existing management practices that minimize impacts of human disturbance (e.g. fence, post and patrol nesting sites). Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Incorporate enforcement of pet restriction regulations into beach nesting bird plans and agreements. Strengthen law enforcement of no-pet restrictions by state conservation officers and park rangers. (<i>Protect habitat – humans</i>)
1°	Develop targeted outreach towards pet owners. (<i>Education - humans</i>)
1°	Increase regular presence of state conservation officers at beach nesting bird sites. (<i>Protect habitat – humans</i>)
Reduce impacts of human disturbance on colonial nesting birds	
1°	Reduce watercraft impacts on colonial waterbirds: Identify important foraging areas and habitats and establish, post, and enforce buffers to restrict watercraft and pedestrian use around nesting areas. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Conduct investigations to establish appropriate buffer sizes to minimize disturbance from watercraft and pedestrians. (<i>Protect habitat – humans</i>)

1

Priority	Conservation Actions (continued)
Protect overwintering colonies and/or “haul out” areas for harbor seals	
2°	Identify and post important “haul-out” areas (e.g. Hereford Inlet) to minimize human disturbance. (<i>Protect habitat – humans</i>)
Reduce excessive predation on beach nesting birds, colonial waterbirds, other species	
1°	Continue existing management practices to reduce predation on beach nesting birds, including techniques such as predator exclosures and electric fence. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Conduct integrated wildlife damage management at important nesting sites for beach nesting birds and colonial waterbirds, especially focusing on feral cats and red fox. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Work with local municipalities to develop policies and/or establish regulations that minimize the impacts of predators on native wildlife species, including bans on feeding of wildlife and bans on “managed” cat colonies near critical wildlife areas. (<i>Conserve wildlife – cats, subsidized predators</i>)
Reduce mortality of northern diamondback terrapin	
1°	Close the harvest season for northern diamondback terrapin. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify key crossing areas and work with local or state transportation agencies to erect turtle barriers. (<i>Protect habitat – roads</i>)
1°	Determine compliance with current crab trap regulations (e.g. turtle excluder devices) and increase enforcement if necessary. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate if current regulations are sufficient. (<i>Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat and migratory corridors	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Assess significance of coastal region as an important travel corridor and concentration site for migratory tree-roosting bats. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
Identify areas to protect to accommodate sea-level change	
2°	Work with Rutgers University's Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping to identify areas along the coast that need protection and/or buffering in the event of significant sea-level rise. <i>(Protect habitat – Landscape Project)</i>
Promote public education and awareness	
1°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. <i>(Education – humans)</i>
1°	Create viewing opportunities for beach nesting birds at Cape May Point SP, Stone Harbor Point, Strathmere NA, and Corson's Inlet SP, and for colonial water birds at selected appropriate locations. <i>(Education – humans)</i>
1°	Encourage and develop opportunities for eco-tourism in the coastal zone. <i>(Education – humans)</i>
1°	Present educational programs to local environmental organizations and community groups to promote understanding of threats to beach nesting, colonial water birds, osprey, and for other coastal species as needed, and to increase environmental stewardship. <i>(Education – humans)</i>
1°	Work with New Jersey Division of Parks and Forestry (NJDPF) to develop and enhance outreach opportunities with regards to beach nesting birds at state parks and natural areas, such as Cape May Point SP, Strathmere NA and Corson's Inlet SP. <i>(Education – humans)</i>
1°	Develop public education materials addressing the impacts of invasive nonindigenous species on native wildlife and habitat quality. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. <i>(Education – humans)</i>
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. <i>(Education – humans)</i>
2°	Develop an outreach brochure about diamondback terrapin biology, behavior and threats, specifically targeting recreational (crab pot) crabbers. <i>(Education – humans)</i>
2°	Develop outreach materials for watercraft users, including mapping component to identify critical feeding and nesting habitats to avoid. <i>(Education – humans)</i>

2

3 f. Potential Partnerships to Deliver Conservation

4 Private Landowners

- 5 • Work with private landowners to maintain or create scrub-shrub habitat for migratory
- 6 songbirds, raptors and butterflies through promotion of “backyard habitat” program.
- 7 • Encourage private owners of dredge material islands to create or enhance habitat suitable for
- 8 colonial nesting birds through landowner incentive programs.
- 9 • Develop and implement landowner incentives for providing, maintaining, and protecting
- 10 summer bat habitat.

Public

- Expand volunteer Citizen Scientist Program recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, local land trusts, The Nature Conservancy–NJ Chapter, and NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Recruit Citizen Scientists and conservation groups to assist with surveying and monitoring of wildlife, including colonial waterbirds, ospreys, peregrine falcons, and migratory shorebirds and songbirds.
 - Involve Citizen Scientists in management and protection projects, such as fencing beach nesting bird breeding sites, erection and placement of osprey nesting platforms, and other appropriate projects.

Wildlife Professionals

- Collaborate with researchers and wildlife managers from other Atlantic coast states to develop best management practices, conservation plans, and surveying protocol for colonial waterbirds, beach nesting birds, and other coastal species.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Foster collaboration with TNC to investigate feasibility of creation of alternate feeding habitat for piping plover at South Cape May Meadows Beach.
- Coordinate efforts to protect northern diamondback terrapin with The Wetlands Institute, especially in identifying areas of high road mortality and to insure that data collection addresses conservation needs.
- Elicit assistance from the New Jersey Audubon Society (NJAS), in particular through coordinated Citizen Scientist Program, to assist in various bird surveys.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds of conservation need.
- Work with conservation organization such as NJAS, American Bird Conservancy, and Cats Indoors! to develop advocacy for appropriate conservation and regulatory issues.
- Work with The Wetlands Institute to develop conservation or survey projects appropriate for summer interns and assist with appropriate outreach projects (e.g. beach walks).
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Encourage the use of Landscape Project critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Academic Institutions

- Collaborate with Richard Stockton College's Coastal Research Center to develop comparisons of manipulated and natural beach systems that can be used to develop a

scientific model to identify suitable beach nesting bird micro-habitats that can be incorporated into beach fill project designs.

- Work with Richard Stockton College to develop appropriate projects for internship program.
- Work with Rutgers University to develop appropriate graduate level research projects in the coastal area, in particular focusing on beach nesting birds and colonial waterbirds.
- Work with Rutgers University Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping of areas that will be potentially impacted by sea-level rise.
- Collaborate with other US and Canadian universities on migration and wintering ecology of waterfowl and other birds of conservation need.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, US Fish and Wildlife Service (USFWS) - NJ Field Office, US Army Corps of Engineers (USACE), US Department of Agriculture (USDA), non-profit organizations, Department of Community Affairs (DCA), and Office of Smart Growth, to protect, enhance, and create habitats to protect populations of coastal species.
 - Municipalities, the New Jersey Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) and Parks and Forestry (DPF), USFWS, the State Wildlife Control Unit, US Department of Agriculture – Animal and Plant Health Inspection Service (USDA-APHIS) – Wildlife Services, and local animal control officers to work together to reduce effects of predators, especially red foxes and feral cats, on beach nesting birds and other critical wildlife.
 - Foster support from the Cape May County Shelter and other appropriate animal welfare groups or agencies to reduce predation of avian species, especially beach nesting birds, by feral and free-roaming domestic cats.
 - DFW and conservation organizations to develop stronger partnerships with municipal environmental commissions to gain support for local conservation efforts, in particular involving beachnesting birds.
 - DFW to create habitat and implement best management practices for coastal marsh birds and migratory songbirds and raptors on Wildlife Management Areas.
 - DFW to work with the USACE and state dredging programs to coordinate the beneficial use of dredge materials for the creation, enhancement, and maintenance of habitat for nesting colonial waterbirds and other wildlife.
 - DFW to coordinate development and implementation of beachnesting bird management plans with USFWS, DPF, USCG, and local municipalities.
 - DFW to work with the USFWS and the USACE, to ensure that beachfill and beach renourishment projects include a beach nesting bird component.
 - DFW, USFWS, USACE, NJ-OCE, DEP's Land Use Regulation Program (LURP), and USDA–Natural Resources Conservation Service (NRCS) to work together to develop dune management policies and techniques that benefit beach nesting birds, while still providing adequate storm protection.
 - Where feasible, continue to shift some responsibilities for management of beach nesting birds to individual municipalities and other agencies, as has already been achieved in the Borough of Avalon and with USCG-TRACEN.

- DFW and conservation organizations to work with appropriate local, county, and state road departments to reduce road mortality to diamondback terrapins, in particular in areas identified as having high-density populations or high incidence of mortality.
- DFW to continue protection measures for northern diamondback terrapin by requiring excluders on commercial crab traps in small creeks and lagoons.
- DFW and local municipalities to limit public access to and disturbance of colonial waterbird breeding colonies and increase presence at beach nesting bird breeding sites.
- DFW to work with state and county mosquito commissions to assess the impacts of insecticides and biological controls on critical wildlife, and improve best management practices for marsh management.
- DFW and conservation organizations to work with Cape May NWR to coordinate conservation and management goals at the refuges's Two-Mile Beach Unit, and to develop protocol for inventory of wildlife present on refuge lands.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state, federal, and non-governmental partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS and land stewards to develop effective plans to eradicate invasive, non-indigenous plants on federal, state, and privately preserved lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, conservation organizations, and land stewards to work with NJ Coastal Heritage Trail to develop more wildlife focused trail destinations or viewing areas, and to elevate importance of eco-tourism.
- DFW to work with NJDEP-OEC, USACE, and other appropriate agencies to develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife.
- DFW to lead in the development of educational materials for public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach nesting and coastal marsh birds, and the importance of the Atlantic Flyway and its associated migratory stopover sites.

- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and colonial waterbird and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, local land trusts, and through mitigation.
- DEP to encourage the use of Landscape Project critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time.
- Monitor efficacy of habitat management, habitat restoration, and invasive species control projects.
- Continue to annually monitor abundance, productivity, distribution, and trends of breeding piping plovers, black skimmers, least terns, common terns, American oystercatchers (beach nesting population only), ospreys (biennial), peregrines, colonial waterbirds (biennial), as well as wintering waterfowl and migratory shorebird communities. Conduct threat assessment including factors relating to nest failure and brood loss.
- Collect baseline data (distribution and abundance) for other coastal species, such as marsh birds, migratory songbirds and raptors, diamondback terrapin, and coastal mammals including bats.
- Conduct Delphi Process every three to four years to update status of coastal species.

2. Atlantic City Area

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring success*

a. Habitats

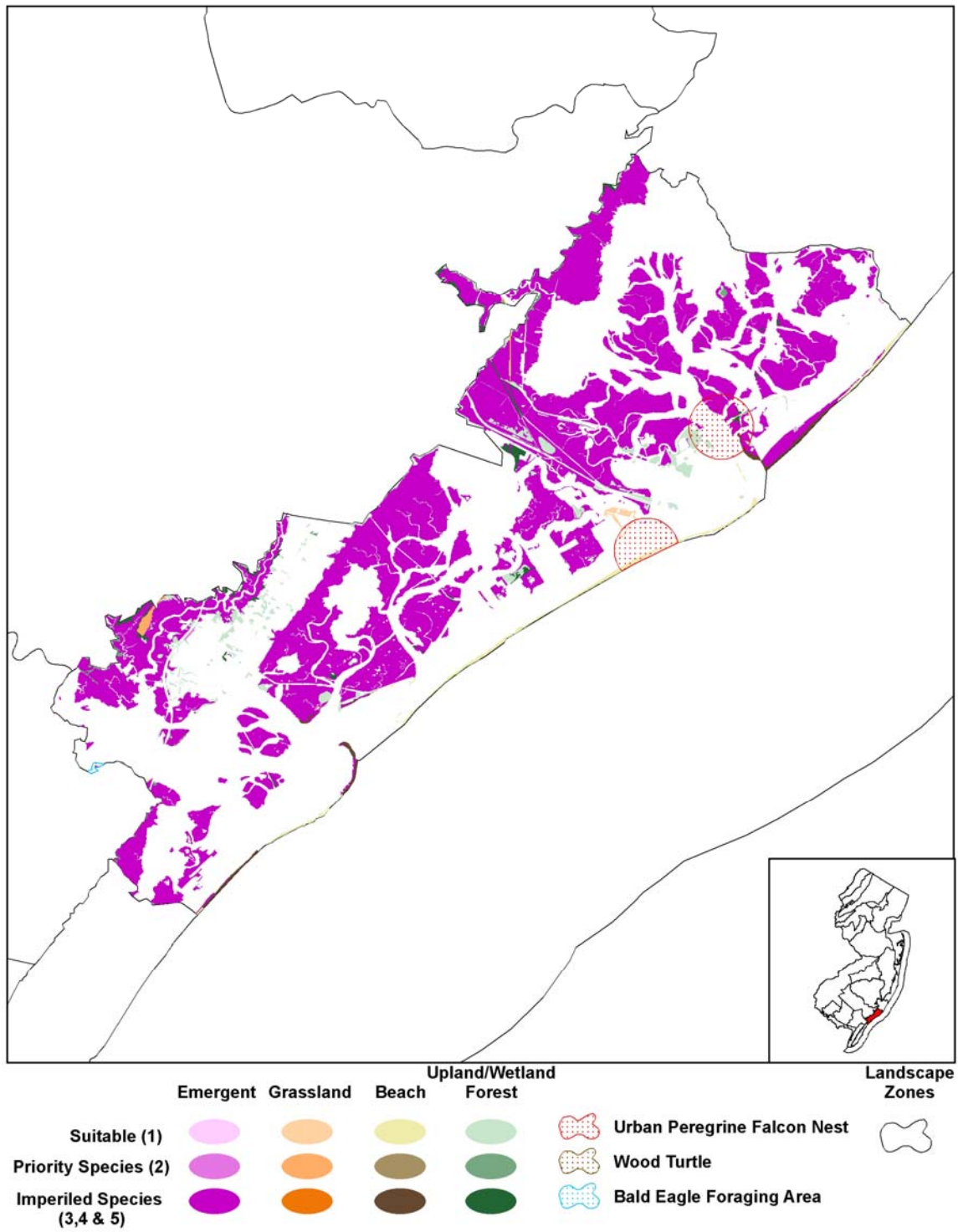
The Atlantic City Area spans the eastern edge of Atlantic County and the northernmost section of Cape May County (Figure 6). It encompasses all or part of several heavily developed barrier islands, including Absecon Island (urban Atlantic City, Ventnor, Margate and Longport), the highly developed portions of Ocean City to the south and the City of Brigantine to the north. The beaches are highly manipulated as a result of ongoing beach renourishment projects and municipal usage patterns, and (with the exception of the beach in the City of Brigantine) are largely characterized by the existence of a boardwalk or bulkhead at the back of the beach instead of a natural dune system. A large area of salt marsh and shallow bays, including portions of the Great Egg and Absecon Bays, and tidal creeks and lagoons, extend west from the western edge of the barrier islands.

Despite the highly developed nature of this zone, some conservation areas of opportunity still exist, including Absecon WMA, Pork Island WMA, and Malibu Beach WMA. Small islands that dot the marshes behind the barrier islands, such as Cow Pen's Island, provide important nesting habitat for numerous species of long-legged colonial waterbirds. The Great Egg Harbor Bay and Inlet provide important estuarine habitat for waterfowl and marine species that may enter the bay. Portions of the Absecon Bay and its associated wetlands, most of which comprise the Absecon WMA, provide important wildlife habitat to a variety of species. These wetlands are especially important because they are contiguous with the extensive protected wetlands of the Edwin B. Forsythe National Wildlife Refuge (Brigantine Division). Beach and dune habitat that is suitable for wildlife is limited, and is not considered optimal due to the heavy recreational usage in this zone, although ongoing beach renourishment projects provide some beach nesting bird habitat.

b. Wildlife of Greatest Conservation Need

The Atlantic City zone supports eight federal endangered or threatened species, seven state endangered species, five state threatened species, and 44 species of special concern or regional priority. The federally endangered or threatened species include the bald eagle and piping plover, as well as sea turtle species that may enter the region's inlets and bays. In addition, summer or migratory populations of bats, potentially including the federal endangered Indiana bat, are suspected to occur in this zone. The American bittern, black skimmer, least tern, northern harrier, peregrine falcon, sedge wren and short-eared owl are state endangered. The black rail, black-crowned night-heron, osprey, red knot, and yellow-crowned night-heron are state threatened. Special concern wildlife include the American oystercatcher, common tern, great blue heron, whimbrel, northern diamondback terrapin, and other coastal marsh birds, colonial waterbirds, migratory shorebirds, reptiles, and amphibians. Back bay salt marshes and coastal sounds in this area are critical wintering areas for Atlantic brant and American black

1 **Figure 6.** Critical landscape habitats within the Atlantic City Area conservation zone, as
 2 identified through the Landscape Map (v2).



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4

ducks in the Atlantic Flyway. Other game species, most notably selected waterfowl species, have been assigned priority status.

Islands in the coastal marsh of this region support significant numbers of nesting long-legged colonial waterbirds, including state threatened black-crowned and yellow-crowned night herons. The coastal marsh also provides important nesting and foraging habitat for American oystercatchers, black skimmers, ospreys, peregrine falcons, and northern diamondback terrapins. Small freshwater wetlands and dune meadows immediately adjacent to coastal salt marshes provide habitat for Fowler's toads. Ledges on tall buildings and bridges in Atlantic City provide adaptive nesting habitat for peregrine falcons. Small numbers of beach nesting birds, including the federally listed piping plover and the state listed least tern and black skimmer nest on the beaches – primarily in Ocean City, where site fidelity remains strong despite heavy disturbance from recreation usage. Therefore, efforts to maximize beach nesting bird reproductive success should continue within this zone where birds nest. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Atlantic City Area Zone

Table C16. Federal Endangered and Threatened Species*

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Indiana bat**				X
Birds				
Bald eagle			X	X
Piping plover		X		
Reptiles				
Green sea turtle	X			
Hawksbill sea turtle	X			
Kemp's ridley sea turtle	X			
Leatherback sea turtle	X			
Loggerhead sea turtle	X			

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

X: Species occurs within the identified habitat.

Table C17. State Endangered Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American bittern			X	
Black skimmer		X	X	
Least tern		X		
Northern harrier			X	X
Peregrine falcon			X	
Sedge wren			X	
Short-eared owl			X	X

X: Species occurs within the identified habitat.

Table C18. State Threatened Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
Black rail			X	
Black-crowned night heron			X	X
Osprey		X	X	
Red knot		X	X	
Yellow-crowned night heron			X	X

X: Species occurs within the identified habitat.

Table C19. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Harbor porpoise	X			
Harbor seal ♦	X	X		
Marsh rice rat			X	
Southern bog lemming			X	X
Birds				
American golden-plover			X	
American oystercatcher		X	X	
Black tern		X		
Caspian tern		X		
Cattle egret			X	
Chimney swift				X
Common barn owl				X
Common tern		X	X	
Forster's tern			X	
Glossy ibis			X	
Great blue heron				X
Great crested flycatcher				X
Great egret			X	
Greater yellowlegs			X	
Green heron			X	X
Gull-billed tern		X	X	
Horned lark		X		
Hudsonian godwit			X	
King rail			X	
Least bittern			X	
Little blue heron			X	
Marbled godwit			X	
Marsh wren			X	
Nelson's sharp-tailed sparrow			X	
Purple sandpiper		X		
Royal tern		X		
Ruddy turnstone		X	X	
Saltmarsh sharp-tailed sparrow			X	
Sanderling		X	X	
Seaside sparrow			X	
Semipalmated sandpiper		X	X	
Snowy egret			X	
Tricolored heron			X	
Whimbrel			X	
Willet		X	X	
Wilson's phalarope		X	X	
Reptiles				
Eastern box turtle				X
Northern diamondback terrapin		X	X	
Amphibians				
Fowler's toad		X		
Fish				
Atlantic sturgeon	X			

♦ Harbor seal primarily present in water, but utilize beach as "haul-outs".

X: Species occurs within the identified habitat.

Table C20. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American black duck	X		X	
Atlantic brant	X		X	
Black scoter	X			
Bufflehead	X		X	
Canada goose (Atlantic population)	X		X	
Canvasback	X		X	
Clapper rail			X	
Common eider *	X			
Greater scaup	X		X	
Harlequin duck*	X			
Lesser scaup	X		X	
Long-tailed duck	X			
Northern pintail	X		X	
Surf scoter	X			
Virginia rail			X	
White-winged scoter	X			

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jettys each winter, but this is insignificant to the overall population status.

X: Species occurs within the identified habitat.

Table C21. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table C22. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJ DFW to be species of concern.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
River otter	X		X	
Birds				
Sora rail			X	

X: Species occurs within the identified habitat

c. Threats to the Wildlife and Habitats

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Lack of suitable beach habitat, due to excessive development of barrier islands and destruction of natural beach strand (boardwalks, bulkheading, other man-made features replacing the dune system), has severely limited opportunities for beach nesting birds. In those few areas where suitable beach habitat exists (e.g. portions of Ocean City and City of Brigantine), intensive dune

and beach management, including overuse of dune fencing, sand mining, and mechanical beach raking, reduces available foraging habitat for piping plovers and migratory shorebirds and poses risks to unfledged piping plover and least tern chicks. Development of the little remaining coastal scrub-shrub and forested habitat reduces habitat critical for migratory raptors, songbirds and butterflies. Invasive plant species, such as phragmites, which dominate many dredge disposal sites and some coastal salt marshes, reduce the suitability of habitat for critical coastal species, including breeding long-legged wading birds, high marsh specialists, and waterfowl. The impacts of aquaculture, particularly for hard clams (*Mercenaria mercenaria*) as well as hydraulic crab dredging are largely unmeasured and poorly understood.

Beach nourishment projects create otherwise suitable habitat in areas of high human use (e.g. Ocean City), increasing impacts of human disturbance on beach nesting birds. Intensive recreational use of all beaches in this zone reduces the likelihood of nesting and severely impacts nesting success for beach nesting birds. In addition, it also creates disturbance to a wide range of migrating shorebirds. Lax enforcement of local “no-dogs-on-beach” ordinances (e.g. in Ocean City) results in severe disturbance of beach nesting birds, with resultant impacts on nesting success. Heavy vehicle usage (and related recreational activities) at the southern end of Brigantine Island creates impediments to beach nesting birds. Boats and personal watercraft create disturbance at back-bay colonial waterbird colonies and osprey nests, especially those located closest to barrier islands, and interfere with foraging throughout the region.

Excessive predation, especially by human-subsidized species (e.g. red fox, crow, gull species, raccoon, striped skunk, free-roaming “owned” or feral cats), severely impairs the breeding success of beach nesting birds and colonial waterbirds breeding success. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect critical habitats identified by the Landscape Project.
- Reduce and mitigate the negative effects of beach nourishment projects on beach nesting birds and their habitat.
- Modify local beach management practices to reduce their adverse effects on beach nesting birds.
- Reduce the adverse impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality.
- Continue to monitor and protect osprey and peregrine falcon.
- Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish species in the Atlantic City Area Zone.
- Preserve populations of endangered, threatened, and special concern fishes.
- Conduct investigations to improve understanding of habitat needs of critical wildlife species.
- Reduce incremental loss of remaining scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species.
- Pursue habitat restoration or enhancement where it would benefit wildlife.
- Improve marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl.

- Reduce deleterious effects of pesticides on coastal species and ecosystems.
- Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat.
- Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets.
- Protect beach nesting bird sites and associated foraging habitats from human disturbance.
- Reduce the impacts of human disturbance on colonial nesting birds.
- Protect overwintering colonies and/or “haul out” areas for harbor seals.
- Reduce excessive predation on beach nesting birds, colonial waterbirds, and other species.
- Reduce mortality of northern diamondback terrapin.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify critical wildlife habitat to protect or buffer to accommodate sea-level change.
- Monitor impacts of wind energy project at Atlantic City MUA on avian species.
- Develop and promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical beach/dune, coastal scrub-shrub, forest, and wetland habitats and assess their condition for nesting, migrating, and wintering birds, and other coastal species. Maintain information and incorporate all new survey and mapping data into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land use regulation, municipal and regional planning, land acquisition priorities and development of management and conservation strategies. (<i>Protect habitat – Landscape Project</i>)
1°	Develop, review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available, including species or species groups (e.g. waterfowl) not currently integrated. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)
Reduce and mitigate negative impacts of beach nourishment for beach nesting birds	
1°	Develop and implement beach management agreements with municipalities. Update existing agreements. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Continue to coordinate with U.S. Army Corps of Engineers (USACE), NJDEP Office of Engineering and Construction (OEC) and Land Use Regulation Program (LURP) to reduce impacts on nesting success of beach nesting birds. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Continue to work with USACE to integrate designs into beach nourishment projects that increase availability of and access to nesting and foraging habitat. <i>(Conserve wildlife – rare wildlife)</i>
1°	Investigate experimental techniques to improve foraging habitat on nourished beaches. <i>(Conserve wildlife – rare wildlife)</i>
Modify local beach management practices to reduce impacts to beach nesting birds	
1°	Work with U.S. Department of Agriculture (USDA) – Natural Resources Conservation Services (NRCS), U.S. Fish and Wildlife Service (USFWS), USACE, and NJDEP LURP to develop best management practices, including dune management policies, to incorporate into beach nesting bird management agreements. <i>(Other practices – land management)</i>
1°	Incorporate limits on beach raking practices into beach nesting bird management agreements. <i>(Protect habitat – Landscape Project; Conserve wildlife – rare wildlife)</i>
Reduce impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality	
1°	Eliminate or reduce phragmites from dredge material sites to allow for the natural succession of woody habitats to benefit nesting long-legged wading birds or create sandy substrate for ground nesting colonial waterbirds at selected sites. “Jump-start” natural vegetation (using nursery stock and seedlings) where appropriate. <i>(Conserve wildlife – rare wildlife, invasives)</i>
1°	Develop and implement best management practices to address adverse effects of both invasive plant or wildlife species (e.g. phragmites, mute swan) and over-abundant native wildlife (e.g. resident Canada geese, greater snow goose) on quality of coastal wetland habitat. <i>(Conserve wildlife – invasives; Other practices – land management)</i>
1°	Assess impacts of gull populations (laughing gull, greater black-back gull, herring gull) on breeding success of beach nesting birds, colonial waterbirds, and other species to determine if integrated wildlife damage management of gulls is necessary. <i>(Conserve wildlife –, subsidized predators)</i>
2°	Monitor encroachment of Japanese sedge in beach/dune habitat and assess impacts on habitat quality. Implement control efforts where appropriate. <i>(Evaluate restoration – invasives)</i>
Monitor and protect osprey and peregrine falcon	
1°	Maintain nesting opportunities through repair and replacement of existing man-made structures. Identify where additional nesting structures would be appropriate. <i>(Conserve wildlife – rare wildlife)</i>

1

Priority	Conservation Actions (continued)
1°	Continue regular monitoring of all known pairs of peregrine falcons, including assessment of productivity and threats. Track other regularly observed birds to determine new nesting pairs/sites. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare species</i>)
1°	Continue regular monitoring of osprey, including coast-wide survey of population and nesting success on biannual basis, and annual assessment of reproductive success at several targeted locations. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare species</i>)
1°	Monitor levels of heavy metals and other contaminants, especially mercury, in eggs, adults and young, to determine effects on reproductive success. (<i>Conserve wildlife – contaminants</i>)
1°	Continue to monitor fish stocks, in particular menhaden, to determine effects of reduced or changing prey base on reproductive success of osprey. (<i>Monitor wildlife – long-term monitoring</i>)
Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish	
1°	Continue intensive monitoring of populations and reproductive success of beach nesting birds, including piping plovers, least terns, black skimmers, common terns, and American oystercatchers. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare species</i>)
2°	Continue surveys of wintering population of American oystercatchers. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare species</i>)
1°	Increase frequency of coast-wide aerial colonial waterbirds surveys to once every other year to better determine population trends and distribution. Continue critical investigation of aerial survey technique through selected “ground truthing” and literature and peer review in order to increase efficacy of survey, minimize surveyor bias and error, and increase accuracy of trend data. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare species</i>)
1°	Determine reproductive success of colonial waterbirds at targeted nesting colonies. Identify factors limiting success, including predators and possible effects of contaminants. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife, contaminants</i>)
1°	Increase understanding of migratory songbird distribution and habitat use by conducting surveys or reviewing existing databases to better identify specific migratory songbird species using coastal habitat, as well as distribution of species. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Conduct surveys to determine distribution, population, and habitat use of coastal marsh birds, in particular high marsh specialists, such as Northern harriers, black rails, and salt marsh sharp-tailed sparrows. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Continue the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Protect habitat – migratory birds; Conserve wildlife – game species</i>)

1

Priority	Conservation Actions (continued)
1°	Continue the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – game species</i>)
2°	Conduct baseline inventory of coastal mammal species, including the marsh rice rat and southern bog lemming. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
Preserve populations of endangered, threatened, and special concern fishes	
1°	Map distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Conserve wildlife – rare wildlife; Protect habitat – fish</i>)
Conduct investigations to improve understanding of habitat needs of critical wildlife species	
1°	Investigate habitat selection of breeding colonial waterbirds, including use of phragmites. (<i>Conserve wildlife – rare wildlife</i>)
1°	Research population distribution of northern diamondback terrapin to determine critical areas for protection. (<i>Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring</i>)
1°	Conduct research to quantify importance of shrub-scrub habitat for migratory songbirds. (<i>Protect habitat – migratory birds</i>)
1°	Investigate impacts of aquaculture on waterfowl and other wildlife. (<i>Aquaculture – land management; Conserve wildlife – game species</i>)
1°	Investigate carrying capacity of coastal salt marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Investigate impacts of hydraulic crab dredging on back-bay habitats and wildlife. (<i>Protect habitat – humans</i>)
1°	Investigate home ranges of wintering Atlantic brant in relation to carrying capacity of back bay habitat for Atlantic brant. (<i>Conserve wildlife – game species</i>)
Reduce loss of scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species	
1°	Identify remaining parcels of scrub-shrub habitat and forest patches and protect through either application of Coastal Zone Management (CZM) “critical wildlife habitat” designation or acquisition. (<i>Protect habitat – Landscape Project, migratory birds</i>)
Pursue habitat restoration or enhancement where it would benefit wildlife	
1°	Determine species of priority for Malibu Beach WMA to help guide habitat restoration or management. (<i>Conserve wildlife – rare wildlife</i>)
1°	Restore natural beach and dune profile at the southern end of Brigantine Island where beach management practices have drastically reduced suitability of breeding habitat for beach nesting birds. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Reduce state regulatory impediments to improving habitat for beach nesting birds and coastal marsh species. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Continue to work with NJDEP-OEC, USACE, and other appropriate agencies to coordinate beneficial placement of dredge materials for creation, enhancement, or maintenance of colonial waterbird nesting, in particular with regards to Intercoastal Waterway restoration projects. Develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Identify locations where undoing the effects of wetland ditching can benefit marsh species, especially high marsh or area-sensitive species, such as northern harriers. Implement restoration of these sites. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Reestablish or restore submerged aquatic vegetation beds in critical areas where they formerly occurred in order to benefit waterfowl species. (<i>Conserve wildlife – game species</i>)
Improve marsh management techniques to benefit critical wildlife species	
1°	Conduct critical assessment of effects of Open Marsh Water Management on wildlife species, in particular high marsh nesting birds and waterfowl. Modify best management practices as appropriate. (<i>Conserve wildlife – rare wildlife, game species; Other practices – land management</i>)
Reduce deleterious effects of pesticides on coastal species and ecosystems	
1°	Support and conduct investigations assessing the impacts of pesticides and biological controls on coastal species, in particular those species dependent on coastal marshes and wetlands. Modify best management practices as appropriate. (<i>Other practices – land management</i>)
Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat	
1°	Continue to provide information to local, state, and federal agencies involved in emergency oil spill response, including assessments of impacts on critical natural resources during and after spill events. Update guidance documents used by agencies to develop strategies to plan for and reduce oil spill impacts. (<i>Protect habitat –oil</i>)
Reduce human disturbance to red knot and other migratory shorebirds	
1°	Identify important staging areas, determine and enforce the necessary restrictions on human activities. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans; Corridors – migratory birds</i>)
1°	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites to implement stringent enforcement of endangered species laws, including harassment and human disturbance. (<i>Protect habitat – humans</i>)

1

Priority	Conservation Actions (continued)
Protect beach nesting bird sites and foraging habitat from human disturbance	
1°	Continue existing management practices that minimize impacts of human disturbance (e.g. fence, post and patrol nesting sites). Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Incorporate enforcement of pet restriction regulations into beach nesting bird plans and agreements. Strengthen law enforcement of no pet restrictions by state conservation officers and park rangers. (<i>Protect habitat – humans</i>)
1°	Develop targeted outreach towards pet owners (Ocean City, City of Brigantine). (<i>Education – humans</i>)
1°	Increase regular presence of state conservation officers at beach nesting bird sites. (<i>Protect habitat – humans</i>)
Reduce impacts of human disturbance on colonial nesting birds	
1°	Reduce watercraft impacts on colonial waterbirds: Identify important foraging areas and habitats and establish, post, and enforce buffers to restrict watercraft and pedestrian use around nesting areas. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Conduct investigations to establish appropriate buffer sizes to minimize disturbance from watercraft and pedestrians. (<i>Protect habitat – humans</i>)
Protect overwintering colonies and/or “haul out” areas for harbor seals	
2°	Identify and post important “haul-out” areas (e.g. Great Egg Harbor Bay) to minimize human disturbance. (<i>Protect habitat – humans</i>)
Reduce excessive predation on beach nesting birds, colonial waterbirds, other species	
1°	Continue existing management practices to reduce predation on beach nesting birds, including techniques such as predator exclosures and electric fence. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Conduct integrated wildlife damage management at important nesting sites for beach nesting birds and colonial waterbirds, especially focusing on feral cats and red foxes. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Work with local municipalities to develop policies and/or establish regulations that minimize the impacts of predators on native wildlife species, including bans on feeding of wildlife and bans on “managed” cat colonies near critical wildlife areas. (<i>Conserve wildlife – cats, subsidized predators</i>)
Reduce mortality of northern diamondback terrapin	
1°	Close the harvest season for northern diamondback terrapin. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify key crossing areas and work with local or state transportation agencies to erect turtle barriers. (<i>Protect habitat – roads</i>)
1°	Determine compliance with current crab trap regulations (e.g. turtle excluder devices) and increase enforcement if necessary. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate if current regulations are sufficient. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
Identify and protect summer bat habitat and migratory corridors	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Assess significance of coastal region as an important travel corridor and concentration site for migratory tree-roosting bats. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Identify areas to protect to accommodate sea-level change	
2°	Work with Rutgers University's Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping to identify areas along the coast that need protection and/or buffering in the event of significant sea-level rise. (<i>Protect habitat – Landscape Project</i>)
Monitor impacts of wind energy project at Atlantic City MUA on avian species	
1°	Work with other agencies or organizations to assist with or direct research on the effects of wind energy towers on wildlife species, especially migratory songbirds, waterfowl, and bats. (<i>Protect habitat – humans; Corridors – migratory birds</i>)
Promote public education and awareness	
1°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
1°	Create viewing opportunities for colonial water birds at selected appropriate locations, such as the Ocean City Visitor's Center, and bayside street ends in Ventnor/Margate and Brigantine. (<i>Education – humans</i>)
1°	Encourage and develop opportunities for eco-tourism in the coastal zone. (<i>Education – humans</i>)
1°	Present educational programs to local environmental organizations and community groups to promote understanding of threats to beach nesting, colonial water birds, osprey, and for other coastal species as needed, and to increase environmental stewardship. (<i>Education – humans</i>)
1°	Develop public education materials addressing the impacts of invasive, non-indigenous species on native wildlife and habitat quality. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)

Priority	Conservation Actions (continued)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)
2°	Develop outreach brochure about diamondback terrapin biology, behavior and threats, specifically targeting recreational (crab pot) crabbers. (<i>Education – humans</i>)
2°	Develop outreach materials for watercraft users, including mapping component to identify critical feeding and nesting habitats to avoid. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Work with private landowners to maintain or create scrub-shrub habitat for migratory songbirds, raptors and butterflies through promotion of “backyard habitat” program.
- Encourage private owners of dredge material islands to create or enhance habitat suitable for colonial nesting birds through landowner incentive programs.
- Continue to work with casino properties to help manage and monitor peregrine falcons that nest on casino tower ledges.
- Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.

Public

- Expand volunteer Citizen Scientist Program recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, local land trusts, The Nature Conservancy – NJ Chapter, and NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Recruit Citizen Scientists and conservation groups to assist with surveying and monitoring of wildlife, including colonial waterbirds, ospreys, peregrine falcons, and migratory shorebirds and songbirds.
 - Involve Citizen Scientists in management and protection projects, such as fencing beach nesting bird breeding sites, erection and placement of osprey nesting platforms, and other appropriate projects.

Wildlife Professionals

- Collaborate with researchers and wildlife managers from other Atlantic coast states to develop best management practices, conservation plans, and surveying protocol for colonial waterbirds, beach nesting birds, and other coastal species.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Coordinate efforts to protect diamondback terrapin with The Wetlands Institute, especially in identifying areas of high road mortality and to insure that data collection addresses conservation needs.
- Elicit assistance from New Jersey Audubon Society, in particular through coordinated Citizen Scientist Program, to assist in various bird surveys.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds of conservation need.
- Work with conservation organization such as New Jersey Audubon Society, Atlantic County Audubon Society, American Bird Conservancy, Cats Indoors!, and Great Egg Harbor Watershed Association to develop advocacy for appropriate conservation and regulatory issues.
- Encourage the use of Landscape Project critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Academic Institutions

- Collaborate with Richard Stockton College's Coastal Research Center to develop comparisons of manipulated and natural beach systems that can be used to develop a scientific model to identify suitable beach nesting bird micro-habitats, which can be incorporated into beach fill project designs.
- Work with Richard Stockton College to develop appropriate projects for internship program.
- Work with Rutgers University to develop appropriate graduate level research projects in the coastal area, in particular focusing on beach nesting birds and colonial waterbirds.
- Work with Rutgers University Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping of areas that will be potentially impacted by sea-level rise.
- Collaborate with other US and Canadian universities on migration and wintering ecology of waterfowl and other birds of conservation need.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USFWS - NJ Field Office, US Army Corps. of Engineers (USACE), USDA, non-profit organizations, Department of Community Affairs (DCA), and Office of Smart Growth to protect, enhance, and create habitats, and to protect populations of coastal species.
 - Municipalities, NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) and Parks and Forestry (DPF), the State Wildlife Control Unit, USDA-APHIS-Wildlife Services, and local animal control officers to work together to reduce the effects of predators, especially red foxes, on beach nesting birds and other critical wildlife.
 - Foster support from the Cape May and Atlantic County Shelters, Ocean City Humane Society and other appropriate animal welfare groups or agencies to reduce predation of avian species, especially beach nesting birds, by feral and free-roaming domestic cats.

- DFW and conservation organizations to develop stronger partnerships with municipal environmental commissions to gain support for local conservation efforts, in particular involving beach nesting birds.
- DFW to create habitat and implement best management practices for coastal marsh birds and migratory songbirds and raptors on state lands.
- DFW to work with the USACE and state dredging programs to create and maintain habitat for nesting colonial waterbirds.
- DFW to coordinate development and implementation of beach nesting bird management plans with USFWS, DPF and local municipalities.
- DFW to work with the USFWS and the USACE, to ensure that beach fill and beach renourishment projects include a beach nesting bird component.
- DFW, USFWS, USACE, NJ-OCE, DEP Land Use Regulation Program (LURP), and USDA – Natural Resources Conservation Service (NRCS) to work together to develop dune management policies and techniques that benefit beach nesting birds, while still providing adequate storm protection.
- Where feasible, continue to shift some responsibilities for management of beach nesting birds to individual municipalities.
- DFW and conservation organizations to work with appropriate local, county, and state road departments to reduce road mortality to northern diamondback terrapins, in particular in areas identified as having high-density populations or high incidence of mortality.
- DFW to continue protection measures for northern diamondback terrapin by requiring excluders on commercial crab traps in small creeks and lagoons.
- DFW and local municipalities to limit public access and disturbance to colonial waterbird breeding colonies and increase presence at beach nesting bird breeding sites.
- DFW to work with state and county mosquito commissions to assess the impacts of insecticides and biological controls on critical wildlife, and improve best management practices for marsh management.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration, to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive, non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through the Natural Resource Conservation Service (NRCS) and the Wildlife Habitat Incentive Program (WHIP) to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW and DEP's Bureau Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.

- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with the DEP's Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, conservation organizations, and land stewards to work with NJ Coastal Heritage Trail to develop more wildlife focused trail destinations or viewing areas, and to elevate the importance of eco-tourism.
- DFW to work with NJDEP-OEC, USACE, and other appropriate agencies to develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife.
- DFW to lead in the development of educational material for public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach nesting and coastal marsh birds, and the importance of the Atlantic Flyway and its associated migratory stopover sites.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and colonial waterbird viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, local land trusts, and through mitigation.
- DEP to encourage the use of Landscape Project critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time.
- Monitor efficacy of habitat management, habitat restoration, and invasive species control projects.
- Continue to annually monitor abundance, productivity, distribution, and trends of breeding piping plovers, black skimmers, least terns, common terns, American oystercatchers (beach nesting population only), ospreys (biennial), peregrine falcons, colonial waterbirds (biennial), as well as wintering waterfowl and migratory shorebird communities. Conduct threat assessment including factors relating to nest failure and brood loss.
- Collect baseline data (distribution and abundance) for other coastal species, such as marsh birds, migratory songbirds and raptors, diamondback terrapins, and coastal mammals including bats.
- Conduct Delphi Process every three to four years to update status of coastal species.

3. Brigantine - Great Bay

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring success*

a. Habitats

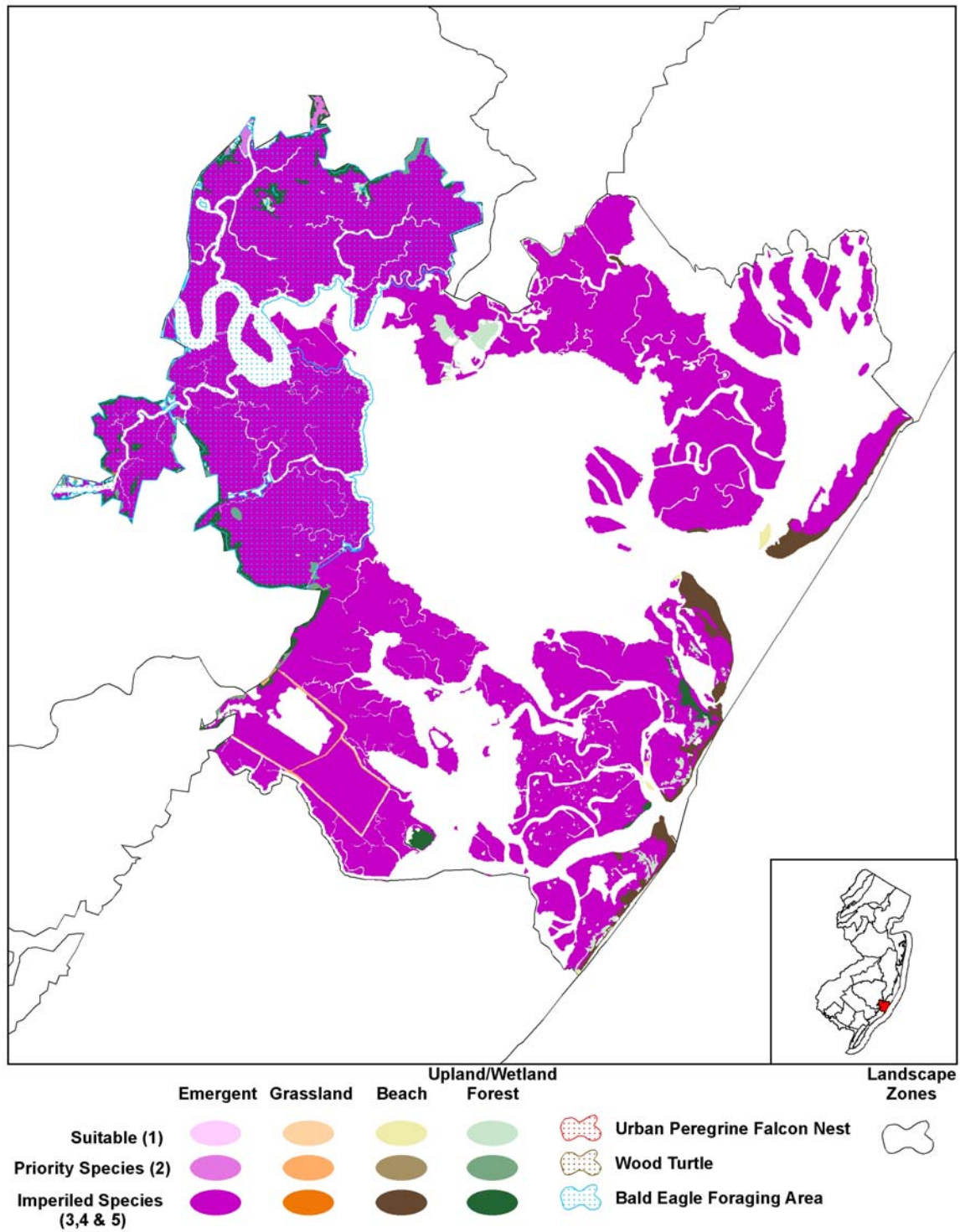
The Atlantic City skyline can be seen across salt meadows that extend south of Long Beach Island to the north of the Brigantine and Great Bay Conservation Priority Area (Figure 7). Squeezed between two heavily developed barrier islands, Absecon Wildlife Management Area (WMA), North Brigantine Natural Area, Edwin B. Forsythe National Wildlife Refuge (NWR), and Great Bay Boulevard WMA are important conservation opportunity areas that preserve the New Jersey coastal habitat, including barrier island beaches and dunes, inlets, tidal salt meadows, marshes, shallow coves, bays, and pristine maritime dune forest and scrub-shrub communities. This entire zone encompasses the only remaining large coastal area in the state that is largely untouched by development or other human alteration, and the Mullica River/Great Bay Watershed is one of the most pristine in the state. Therefore, this zone is one of the most critical for wildlife within the coastal region and state.

b. Wildlife of Greatest Conservation Need

The Brigantine – Great Bay zone supports nine federal endangered or threatened species, nine state endangered species, five state threatened species, and 44 species of special concern or regional priority. The federal or endangered species are the bald eagle, piping plover, and northeastern beach tiger beetle (reintroduction candidate), as well as sea turtle species that may enter the region's inlets and bays. In addition, summer populations of bats, potentially including the federal endangered Indiana bat, are suspected to occur in the zone. The American bittern, black skimmer, least tern, northern harrier, peregrine falcon, pied-billed grebe, sedge wren, short-eared owl, and Cope's gray treefrog are state endangered. The black rail, black-crowned night-heron, osprey, red knot, and yellow-crowned night-heron are state threatened. Special concern wildlife include the American oystercatcher, common tern, forster's tern, whimbrel, northern diamondback terrapin, and other coastal marsh birds, colonial waterbirds, migratory shorebirds, reptiles, and amphibians. Back bay salt marshes and coastal sounds in this area are critical wintering areas for Atlantic brant and American black ducks in the Atlantic Flyway. Other game species, most notably selected waterfowl species, have been assigned priority status.

Along the Atlantic Flyway, the Brigantine - Great Bay area is an important stopover for migrating colonial waterbirds, waterfowl, shorebirds, songbirds and raptors, and provides significant wintering habitat for a variety of waterfowl species. Undeveloped barrier beaches provide critical nesting habitat for the black skimmer, least tern, black ducks, and piping plover, and other beach nesting species. Bald eagles, ospreys, peregrine falcons, and coastal marsh birds nest and forage in the vast salt meadows. Northern diamondback terrapin can also be found in the salt meadows and tidal bays and creeks; and beaches in this zone, where no bulkhead or other impediments exist, provide them with extensive nesting habitat. Marine mammals, sea turtles, and some species of anadromous fish utilize estuarine habitat, including inlets and bays. Harbor

1 **Figure 7.** Critical landscape habitats within the Brigantine - Great Bay conservation zone, as
 2 identified through the Landscape Map (v2).



seals also use sandy beaches and sand bars within Great Bay as winter “haul-out” locations. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Brigantine – Great Bay Zone

Table C23. Federal Endangered and Threatened Species*

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle			X	X
Piping plover		X		
Reptiles				
Green sea turtle	X			
Hawksbill sea turtle	X			
Kemp’s ridley sea turtle	X			
Leatherback sea turtle	X			
Loggerhead sea turtle	X			
Insects				
Northeastern beach tiger beetle		R		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

Table C24. State Endangered Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American bittern			X	
Black skimmer		X	X	
Least tern		X		
Northern harrier			X	X
Peregrine falcon			X	
Sedge wren			X	
Short-eared owl			X	X
Amphibians				
Cope’s gray treefrog			X	

X: Species occurs within the identified habitat.

Table C25. State Threatened Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
Black rail			X	
Black-crowned night heron			X	X
Osprey		X	X	
Red knot		X	X	
Yellow-crowned night heron			X	X

X: Species occurs within the identified habitat.

Table C26. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Harbor porpoise	X			
Harbor seal ♦	X	X		
Marsh rice rat			X	
Southern bog lemming			X	X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American golden-plover			X	
American oystercatcher		X	X	
Black tern		X		
Caspian tern		X		
Cattle egret			X	
Chimney swift				X
Common barn owl				X
Common tern		X	X	
Forster's tern			X	
Glossy ibis			X	
Great blue heron				X
Great crested flycatcher				X
Great egret			X	
Greater yellowlegs			X	
Green heron			X	X
Gull-billed tern		X	X	
Horned lark		X		
Hudsonian godwit			X	
King rail			X	
Least bittern			X	
Little blue heron			X	
Marbled godwit			X	
Marsh wren			X	
Nelson's sharp-tailed sparrow			X	
Purple sandpiper		X		
Royal tern		X		
Ruddy turnstone		X	X	
Saltmarsh sharp-tailed sparrow			X	
Sanderling		X	X	
Seaside sparrow			X	
Semipalmated sandpiper		X	X	
Snowy egret			X	
Tricolored heron			X	
Whimbrel			X	
Willet		X	X	
Wilson's phalarope		X	X	
Reptiles				
Eastern box turtle				X
Northern diamondback terrapin		X	X	
Amphibians				
Fowler's toad		X		
Fish				
Atlantic sturgeon	X			

♦ Harbor seal primarily present in water, but utilize beach as "haul-outs".

X: Species occurs within the identified habitat.

5 Table C27. Game Species of Regional Priority

6 Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American black duck	X		X	
Atlantic brant	X		X	
Black scoter	X			
Bufflehead	X		X	
Canada goose (Atlantic population)	X		X	
Canvasback	X		X	
Clapper rail			X	
Common eider *	X			
Greater scaup	X		X	

Game Species of Regional Priority (continued)

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds (continued)				
Harlequin duck*	X			
Lesser scaup	X		X	
Long-tailed duck	X			
Northern pintail	X		X	
Surf scoter	X			
Virginia rail			X	
White-winged scoter	X			

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jettys each winter, but this is insignificant to the overall population status.

X: Species occurs within the identified habitat.

Table C28. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table C29. Game Species.

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
River otter	X		X	
Birds				
Sora rail			X	

X: Species occurs within the identified habitat

c. Threats to the Wildlife and Habitats

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Brigantine-Great Bay zone is the least impacted by habitat loss and habitat manipulation because much of the barrier island beach strand and coastal marsh is undeveloped, federally or state protected land. Furthermore, none of the beaches within the zone are part of beach replenishment projects. However, upland portions of the zone on the western edge of the back bay, including scrub-shrub and forested habitat critical for migratory raptors, songbirds, and butterflies, continue to be under heavy pressure from residential and commercial development. Other habitat concerns include phragmite's intrusion or domination of salt marsh habitat and dredge disposal sites, which reduces the suitability of habitat for a variety of breeding or wintering species, including long-legged wading birds, marsh birds, and waterfowl. The impacts of aquaculture, particularly for hard clams (*Mercenaria mercenaria*) as well as hydraulic crab dredging, are largely unmeasured and poorly understood.

Boats and personal watercraft create disturbance at back-bay colonial waterbird colonies, osprey nests, and interfere with foraging throughout the region. Harbor seal “haul-out” areas in this zone are also subject to boat and personal watercraft disturbance.

Excessive predation by human subsidized species (e.g. red fox, crow, gull species, raccoon, striped skunk, free roaming “owned or feral cats), even in areas separated from residential development, severely impairs beach nesting bird and colonial waterbirds breeding success. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect critical habitats identified by the Landscape Project.
- Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone.
- Reduce the adverse impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality.
- Continue to monitor and protect osprey and peregrine falcons.
- Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish species in the Brigantine - Great Bay Zone.
- Preserve populations of endangered, threatened, and special concern fishes.
- Conduct investigations to improve understanding of habitat needs of critical wildlife species.
- Reduce incremental loss of remaining scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species.
- Identify areas where additional habitat-based regulatory measures or land acquisition would be appropriate to benefit wildlife.
- Pursue habitat restoration or enhancement where it would benefit wildlife.
- Improve marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl.
- Reduce deleterious effects of pesticides on coastal species and ecosystems.
- Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat.
- Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets.
- Protect beach nesting bird sites and associated foraging habitats from human disturbance.
- Reduce the impacts of human disturbance on colonial nesting birds.
- Protect overwintering colonies and/or “haul out” areas for harbor seals.
- Reduce excessive predation on beach nesting birds, colonial waterbirds, and other species.
- Reduce mortality of northern diamondback terrapin.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Reintroduce northeastern beach tiger beetle to appropriate beach sites.
- Identify critical wildlife habitat to protect or buffer to accommodate sea-level change.
- Develop and promote public awareness and conservation.

1 e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical beach/dune, coastal scrub-shrub, forest, and wetland habitats and assess their condition for nesting, migrating, and wintering birds, and other coastal species. Maintain information and incorporate all new survey and mapping data into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land use regulation, municipal and regional planning, land acquisition priorities and development of management and conservation strategies. (<i>Protect habitat – Landscape Project</i>)
1°	Develop, review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available, including species or species groups (e.g. waterfowl) not currently integrated. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project; migratory birds</i>)
Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone	
1°	Assess the effectiveness of the existing agreement with the City of Brigantine to manage North Brigantine Natural Area for the protection of beach nesting birds. Implement changes as necessary. (<i>Protect habitat – Landscape Project</i>)
1°	Determine if additional measures would be appropriate to protect migratory shorebirds, diamondback terrapins, and other species using the North Brigantine Natural Area. (<i>Protect habitat – Landscape Project; Protect habitat – migratory birds</i>)
1°	Develop a management plan through NJ Division of Parks and Forestry for North Brigantine Natural Area. Ensure that it has a strong beach nesting bird management component. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop a management plan for Absecon and Great Bay WMA through NJ Bureau of Land Management that is consistent with the overall conservation goals of the zone. (<i>Protect habitat – Landscape Project</i>)
1°	Review Comprehensive Management Plan for Edwin B. Forsythe NWR to coordinate long-range planning goals and strategies, especially with regards to development of their Habitat Management Plan. (<i>Protect habitat – Landscape Project</i>)

2

Priority	Conservation Actions (continued)
Reduce impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality	
1°	Eliminate or reduce phragmites from dredge material sites to allow for the natural succession of woody habitats to benefit nesting long-legged wading birds or create sandy substrate for ground nesting colonial waterbirds at selected sites. “Jump-start” natural vegetation (using nursery stock and seedlings) where appropriate. <i>(Conserve wildlife – rare wildlife, invasives)</i>
1°	Develop and implement best management practices to address adverse effects of both invasive plant and wildlife species (e.g. phragmites, mute swan) and over-abundant native wildlife (e.g. resident Canada geese, greater snow goose) on quality of coastal wetland habitat. <i>(Conserve wildlife – invasives; Other practice – land management)</i>
1°	Assess impacts of gull populations (laughing gull, greater black-back gull, herring gull) on breeding success of beach nesting birds, colonial waterbirds, and other species to determine if integrated wildlife damage management of gulls is necessary. <i>(Conserve wildlife –, subsidized predators)</i>
2°	Monitor encroachment of Japanese sedge in beach/dune habitat and assess impacts on habitat quality. Implement control efforts where appropriate. <i>(Evaluate restoration – invasives)</i>
Monitor and protect osprey and peregrine falcon	
1°	Maintain nesting opportunities through repair and replacement of existing man-made structures. Identify where additional nesting structures would be appropriate, such as the Edwin B. Forsythe NWR and Great Bay WMA. <i>(Conserve wildlife – rare wildlife)</i>
1°	Continue regular monitoring of all known pairs of peregrine falcon, including assessment of productivity and threats. Track other regularly observed birds to determine new nesting pairs/sites. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
1°	Continue regular monitoring of osprey, including coast wide survey of population and nesting success on biannual basis, and annual assessment of reproductive success at several targeted locations. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
1°	Monitor levels of heavy metals and other contaminants, especially Mercury, in eggs, adults and young, to determine effects on reproductive success. <i>(Conserve wildlife – contaminants)</i>
1°	Continue to monitor fish stocks, in particular menhaden, to determine effects of reduced or changing prey base on reproductive success of osprey. <i>(Monitor wildlife – long-term monitoring)</i>
Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish	
1°	Continue intensive monitoring of populations and reproductive success of beach nesting birds, including piping plover, least tern, black skimmer, common tern and American oystercatcher. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>

Priority	Conservation Actions (continued)
2°	Continue surveys of wintering population of American oystercatcher. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Increase frequency of coast wide aerial colonial waterbirds surveys to once every other year to better determine population trends and distribution. Continue critical investigation of aerial survey technique through selected “ground truthing” and literature and peer review in order to increase efficacy of survey, minimize surveyor bias and error, and increase accuracy of trend data. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Determine reproductive success of colonial waterbirds at targeted nesting colonies. Identify factors limiting success, including predators and possible effects of contaminants. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife, contaminants</i>)
1°	Increase understanding of migratory songbird distribution and habitat use by conducting surveys or reviewing existing databases to better identify specific migratory songbird species using coastal habitat, as well as distribution of species. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Conduct surveys to determine distribution, population, and habitat use of coastal marsh birds, in particular high marsh specialists, such as Northern harrier, black rails and salt marsh sharp-tailed sparrow. (<i>Monitor wildlife – long-term monitoring; Conserve Wildlife – rare wildlife</i>)
1°	Continue the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Protect habitat – migratory birds; Conserve wildlife – game species</i>)
1°	Continue the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – game species</i>)
2°	Conduct baseline inventory of coastal mammal species, including marsh rice rat and southern bog lemming. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
Preserve populations of endangered, threatened, and special concern fishes	
1°	Map distributions of special concern fish species, and integrate those data into the Landscape Project’s habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Conserve wildlife – rare wildlife; Protect habitat – fish</i>)
Conduct investigations to improve understanding of habitat needs of critical wildlife species	
1°	Pursue investigations of comparative reproductive success of American oystercatcher and common terns on beach- vs. marsh-nesting habitat at selected sites, including identification of specific threats. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate habitat selection of breeding colonial waterbirds, including use of phragmites. (<i>Protect habitat – Landscape Project</i>)
1°	Research population distribution of northern diamondback terrapin to determine critical areas for protection. (<i>Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring</i>)

Priority	Conservation Actions (continued)
1°	Conduct research to quantify importance of shrub-scrub habitat for migratory songbirds. (<i>Protect habitat – migratory birds</i>)
1°	Investigate impacts of aquaculture on waterfowl and other wildlife. (<i>Aquaculture – land management; Conserve wildlife – game species</i>)
1°	Investigate carrying capacity of coastal salt marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Investigate impacts of hydraulic crab dredging on back-bay habitats and wildlife. (<i>Protect habitat – humans</i>)
1°	Investigate home ranges of wintering Atlantic brant in relation to carrying capacity of back bay habitat for Atlantic brant. (<i>Conserve wildlife – game species</i>)
Reduce loss of scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species	
1°	Identify remaining parcels of scrub-shrub habitat and forest patches and protect through either application of Coastal Zone Management (CZM) “critical wildlife habitat” designation or acquisition. (<i>Protect habitat – Landscape Project, migratory birds</i>)
Identify areas where additional habitat-based regulatory protection or land acquisition would be appropriate.	
1°	Identify specific areas of the zone where it would be appropriate to restrict human activities detrimental to wildlife or habitat. Determine guiding criteria for establishing restrictions. Implement establishment of a Marine Conservation Zone or equivalent regulatory restrictions. (<i>Protect habitat – Landscape Project, humans</i>)
1°	Acquire or facilitate acquisition of land adjacent to Edwin B. Forsythe NWR, Absecon WMA, and Great Bay WMA to fill critical gaps in public land holdings and/or to buffer existing holdings. (<i>Protect habitat – Landscape Project; Corridors – sprawl</i>)
Pursue habitat restoration or enhancement where it would benefit wildlife	
1°	Identify species, such as colonial waterbirds, peregrine, and osprey that would benefit from habitat restoration at the “Fish Factory” site. Work with appropriate agencies to develop and implement a habitat restoration plan. (<i>Conserve wildlife – rare wildlife</i>)
1°	Reduce state regulatory impediments to improving habitat for beach nesting birds and coastal marsh species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify locations where undoing the effects of wetland ditching can benefit marsh species, especially high marsh or area-sensitive species, such as northern harriers. Implement restoration of these sites. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)

1

Priority	Conservation Actions (continued)
1°	Continue to work with NJDEP-OEC, USACE, and other appropriate agencies to coordinate beneficial placement of dredge materials for creation, enhancement, or maintenance of colonial waterbird nesting, in particular with regards to Intercoastal Waterway restoration projects. Develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Reestablish or restore submerged aquatic vegetation beds in critical areas where they formerly occurred in order to benefit waterfowl species. (<i>Conserve wildlife – game species</i>)
Improve marsh management techniques to benefit critical wildlife species	
1°	Conduct critical assessment of effects of Open Marsh Water Management on wildlife species, in particular high marsh nesting birds and waterfowl. Modify best management practices as appropriate. (<i>Conserve wildlife – rare wildlife, game species; Other practices – land management</i>)
Reduce deleterious effects of pesticides on coastal species and ecosystems	
1°	Support and conduct investigations assessing the impacts of pesticides and biological controls on coastal species, in particular those species dependent on coastal marshes and wetlands. Modify best management practices as appropriate. (<i>Other practices – land management</i>)
Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat	
1°	Continue to provide information to local, state, and federal agencies involved in emergency oil spill response, including assessments of impacts on critical natural resources during and after spill events. Update guidance documents used by agencies to develop strategies to plan for and reduce impacts of oil spill. (<i>Protect habitat – oil</i>)
Reduce human disturbance to red knot and other migratory shorebirds	
1°	Identify important staging areas, determine and enforce the necessary restrictions on human activities. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans; Corridors – migratory birds</i>)
1°	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites to implement stringent enforcement of endangered species laws including harassment and human disturbance. (<i>Protect habitat – humans</i>)
Protect beach nesting bird sites and foraging habitat from human disturbance	
1°	Continue existing management practices that minimize impacts of human disturbance (e.g. fence, post and patrol nesting sites). Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Incorporate enforcement of pet restriction regulations into beach nesting bird plans and agreements. Strengthen law enforcement of no pet restrictions by state conservation officers and park rangers. (<i>Protect habitat – humans</i>)

2

Priority	Conservation Actions (continued)
1°	Develop targeted outreach towards pet owners. (<i>Education – humans</i>)
1°	Increase regular presence of state conservation officers at beachnesting bird sites. (<i>Protect habitat – humans</i>)
Reduce impacts of human disturbance on colonial nesting birds	
1°	Reduce watercraft impacts on colonial waterbirds: Identify important foraging areas and habitats and establish, post, and enforce buffers to restrict watercraft and pedestrian use around nesting areas. Elicit assistance from staff at Edwin B. Forsythe NWR to implement on refuge lands. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Conduct investigations to establish appropriate buffer sizes to minimize disturbance from watercraft and pedestrians. (<i>Protect habitat – humans</i>)
Protect overwintering colonies and/or “haul out” areas for harbor seals	
2°	Identify and post important “haul-out” areas (e.g. Great Bay) to minimize human disturbance. (<i>Protect habitat – humans</i>)
Reduce excessive predation on beach nesting birds, colonial waterbirds, other species	
1°	Continue existing management practices to reduce predation on beach nesting birds, including techniques such as predator exclosures and electric fence. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Reduce fox predation on beach nesting birds and diamondback terrapin at North Brigantine Natural Area either through integrated wildlife damage management or by encouraging trapping at the site during the legal hunting season. Work with USFWS and USDA-APHIS to reduce predation at Little Beach Island and the Holgate Unit of the Edwin B. Forsythe NWR, federally owned sites crucial to the recovery of piping plover in the state. (<i>Conserve wildlife –, subsidized predators</i>)
1°	Work with local municipalities to develop policies and/or establish regulations that minimize the impacts of predators on native wildlife species, including bans on feeding of wildlife and bans on “managed” cat colonies near critical wildlife areas. (<i>Conserve wildlife – cats, subsidized predators</i>)
Reduce mortality of northern diamondback terrapin	
1°	Close the harvest season for northern diamondback terrapin. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify key crossing areas and work with local or state transportation agencies to erect turtle barriers. (<i>Protect habitat – roads</i>)
1°	Determine compliance with current crab trap regulations (e.g. turtle excluder devices) and increase enforcement if necessary. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate if current regulations are sufficient. (<i>Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat and migratory corridors	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)

Priority	Conservation Actions (continued)
1°	Assess significance of coastal region as an important travel corridor and concentration site for migratory tree bats. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Reintroduce northeastern beach tiger beetle to appropriate beach sites	
1°	Work with USFWS to implement reintroduction of northeastern beach tiger beetle at Holgate Unit of Edwin B. Forsythe NWR. (<i>Conserve wildlife – rare wildlife</i>)
Identify areas to protect to accommodate sea-level change	
2°	Work with Rutgers University's Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping to identify areas along the coast that need protection and/or buffering in the event of significant sea-level rise. (<i>Protect habitat – Landscape Project</i>)
Promote public education and awareness	
1°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
1°	Create viewing opportunities for beach nesting birds and shorebirds at North Brigantine Natural Area, and for colonial water birds at selected appropriate locations. (<i>Education – humans</i>)
1°	Encourage and develop opportunities for eco-tourism in the coastal zone. (<i>Education – humans</i>)
1°	Present educational programs to local environmental organizations and community groups to promote understanding of threats to beach nesting, colonial water birds, osprey, and for other coastal species as needed, and to increase environmental stewardship. (<i>Education – humans</i>)
1°	Work with New Jersey Division of Parks and Forestry (NJDPF) to develop and enhance outreach opportunities with regards to beach nesting birds and other wildlife species at North Brigantine Natural Area. (<i>Education – humans</i>)
1°	Develop public education materials addressing the impacts of invasive nonindigenous species on native wildlife and habitat quality. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of nonindigenous species that invade natural plant communities. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)

Priority	Conservation Actions (continued)
2°	Develop outreach brochure about diamondback terrapin biology, behavior and threats, specifically targeting recreational (crab pot) crabbers. (<i>Education – humans</i>)
2°	Develop outreach materials for watercraft users, including mapping component to identify critical feeding and nesting habitats to avoid. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Work with private landowners to maintain or create scrub-shrub habitat for migratory songbirds, raptors and butterflies through promotion of “backyard habitat” program.
- Encourage private owners of dredge material islands to create or enhance habitat suitable for colonial nesting birds through landowner incentive programs.
- Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.

Public

- Expand volunteer Citizen Scientist Program recruitment and activities.
 - Collaborate with conservation groups (NJ Audubon Society, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, etc.) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
 - Recruit Citizen Scientists and conservation groups to assist with surveying and monitoring of wildlife, including colonial waterbirds, osprey, peregrine falcon, and migratory shorebirds and songbirds.
 - Involve Citizen Scientists in management and protection projects, such as fencing beach nesting bird breeding sites, erection and placement of osprey nesting platforms, and other appropriate projects.
 - Elicit public assistance for wildlife management projects at North Brigantine Natural Area from beach buggy and fishing organization (e.g. New Jersey Beach Buggy Association).

Wildlife Professionals

- Collaborate with researchers and wildlife managers from other Atlantic coast states to develop best management practices, conservation plans, and surveying protocol for colonial waterbirds, beach nesting birds, and other coastal species.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Coordinate efforts to protect diamondback terrapin with The Wetlands Institute, especially in identifying areas of high road mortality and to insure that data collection addresses conservation needs.
- Elicit assistance from New Jersey Audubon Society, in particular through coordinated Citizen Scientist Program, to assist in various bird surveys.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds of conservation need.
- Work with the Tuckerton Seaport and Jacques Cousteau National Estuarine Research Reserve to coordinate conservation efforts and develop outreach opportunities.
- Work with conservation organization such as New Jersey Audubon Society, Atlantic Audubon Society, American Bird Conservancy, Cats Indoors!, etc. to develop advocacy for appropriate conservation and regulatory issues.
- Encourage the use of Landscape Project critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Academic Institutions

- Collaborate with Richard Stockton College's Coastal Research Center to develop a scientific comparisons of manipulated and natural beach systems that can be used to develop model to identify suitable beach nesting bird micro-habitats, which can be incorporated into beachfill project designs.
- Work with Richard Stockton College to develop appropriate projects for internship program.
- Work with Rutgers University to develop appropriate graduate level research projects in the coastal area, in particular focusing on beach nesting birds and colonial waterbirds.
- Work with Rutgers University Marine Field Station to develop research projects and help integrate aquatic and terrestrial resource needs of the estuary.
- Work with Drexel University on northern diamondback terrapin research and help frame projects to meet conservations needs.
- Work with Rutgers University Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping of areas that will be potentially impacted by sea-level rise.
- Collaborate with other US and Canadian universities on migration and wintering ecology of waterfowl and other birds of conservation need.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USFWS - NJ Field Office, US Army Corps. of Engineers (USACE), USDA, non-profit organizations, Department of Community Affairs (DCA), and Office of Smart Growth to protect, enhance, and create habitats; and protect populations of coastal species.
 - Municipalities, NJ Department of Environmental Protections Division's (DEP) of Fish and Wildlife (DFW) and Parks and Forestry (DPF), the State Wildlife Control Unit, USDA-APHIS-Wildlife Services, and local animal control officers to work together to reduce the effects of predators, especially red fox, on beach nesting birds and other critical wildlife.

- DFW to work with the City of Brigantine and the Division of Parks and Forestry to implement management agreement for North Brigantine Natural Area in a way that best protects resources.
- DFW to work with the City of Brigantine to modify existing beach management practices on municipal beaches at southern end of Brigantine Island to restore habitat for beachnesting birds.
- DFW and USFWS staff to work to create habitat and implement best management practices for coastal marsh birds and migratory songbirds and raptors on federal refuge and state lands.
- DFW to work with the USACE and state dredging programs to create and maintain habitat for nesting colonial waterbirds.
- DFW to coordinate development and implementation of beachnesting bird management plans with USFWS, NJDEP, and local municipalities.
- DFW to work with Edwin B. Forsythe National Wildlife Refuge (NWR) to meet conservation and management goals of the zone and to develop protocol for inventory of wildlife present on refuge lands.
- DFW and conservation organizations to work with appropriate local, county, and state road departments to reduce road mortality to diamondback terrapins, in particular in areas identified as having high-density populations or high incidence of mortality.
- DFW to continue protection measures for northern diamondback terrapin by requiring excluders on commercial crab traps in small creeks and lagoons.
- DFW and local municipalities to limit public access and disturbance to colonial waterbird breeding colonies and increase presence at beach nesting bird breeding sites.
- DFW to work with state and county mosquito commissions to assess the impacts of insecticides and biological controls on critical wildlife, and improve best management practices for marsh management.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in waterbodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.

- DFW to work with DEP's Land Use Regulation Program (LURP) to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, conservation organizations, and land stewards to work with NJ Coastal Heritage Trail to develop more wildlife focused trail destinations or viewing areas, and to elevate the importance of eco-tourism.
- DFW to work with NJDEP-OEC, USACE, and other appropriate agencies to develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach nesting and coastal marsh birds, and the importance of the Atlantic Flyway and its associated migratory stopover sites.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and colonial waterbird viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, local land trusts, and through mitigation.
- DEP to encourage the use of Landscape Project critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time.
- Monitor efficacy of habitat management, habitat restoration, and invasive species control projects.
- Continue to annually monitor abundance, productivity, distribution, and trends of breeding piping plover, black skimmer, least tern, common tern, American oystercatcher (beach nesting population only), osprey (biennial), peregrine, colonial waterbirds (biennial), as well as wintering waterfowl and migratory shorebird communities. Conduct threat assessment including factors relating to nest failure and brood loss.
- Collect baseline data (distribution and abundance) for other coastal species, such as marsh birds, migratory songbirds and raptors, diamondback terrapin, and coastal mammals including bats.
- Conduct Delphi Process every three to four years to update status of coastal species.

4. Barnegat Bay - Little Egg Harbor

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring success*

a. Habitats

The Barnegat Bay - Little Egg Harbor zone spans the eastern edge of southern Ocean County, including all of Long Beach Island, as well as Island Beach State Park directly to the north (Figure 8). The vegetated dune communities of Island Beach State Park extend almost eight miles, making this one of the few and largest sections of undeveloped barrier island in the state. In contrast, beaches in resort towns to the north and Long Beach Island to the south, where limited (or no) dune systems exist, provide limited habitat for coastal species. The zone includes a large portion of Barnegat Bay, the state's largest and longest coastal back bay, and the extensive saline marshes of the Edwin B. Forsythe NWR and Manahawkin WMA. Across Little Egg Harbor and Barnegat Bay, there are tidal salt meadows and marshes, shallow inlets and coves, upland pitch pine forests, oak forests, and white cedar-red maple swamps.

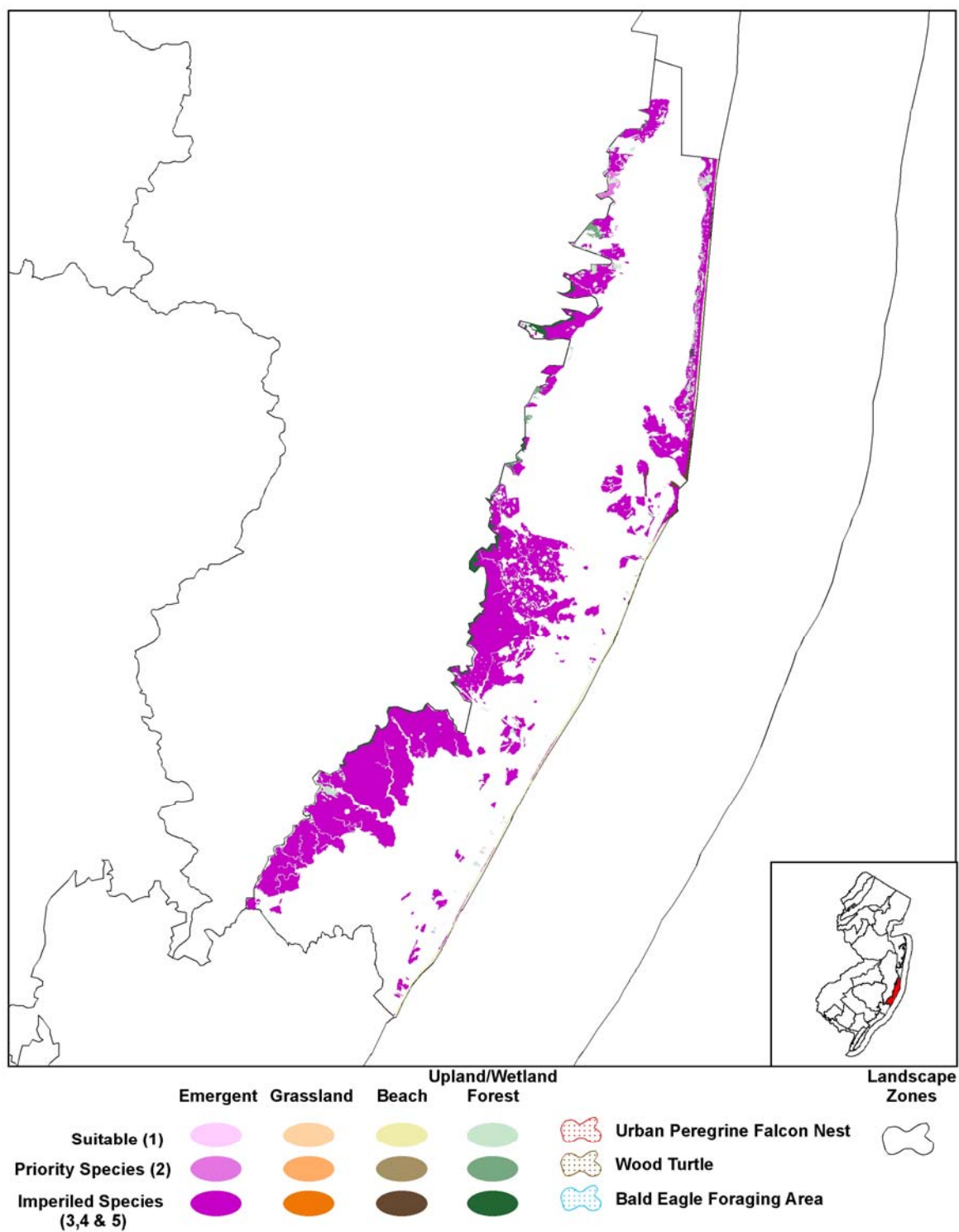
The conservation areas of opportunity in the Barnegat Bay - Little Egg Harbor zone are the Edwin B. Forsythe NWR (Barnegat Division), Manahawkin WMA, Island Beach State Park (including the Southern and Northern Natural Areas, and Sedge Islands WMA and Marine Conservation Zone). Beach habitat at the Barnegat Lighthouse State Park and the adjoining portion of the beach along the inlet jetty have historically provided important habitat for large numbers of beach nesting birds, and could so again if habitat restoration was implemented.

b. Wildlife of Greatest Conservation Need

The Barnegat Bay - Little Egg Harbor zone supports eleven federally endangered or threatened species, nine state endangered species, five state threatened species, and 42 species of special concern or regional priority. The federally endangered or threatened species are bald eagle, bog turtle, piping plover, northeastern beach tiger beetle (reintroduction candidate), roseate tern (historical), as well as sea turtle species that may enter the region's inlets and bays. In addition, summer or migratory populations of bats, potentially including the federally endangered Indiana bat, are suspected to occur in the zone. American bittern, black skimmer, least tern, northern harrier, peregrine falcon, pied-billed grebe, sedge wren, short-eared owl, and Cope's gray treefrog are state endangered. Black rail, black-crowned night-heron, osprey, red knot, and yellow-crowned night-heron are state threatened. Special concern wildlife include American oystercatcher, common terns, various species of herons and egrets, eastern box turtle, northern diamondback terrapin, and Fowler's toad. Back bay salt marshes and coastal sounds in this area are critical wintering areas for Atlantic brant and American black ducks in the Atlantic Flyway. Significant numbers of lesser and greater scaup winter in this area. Other game species, most notably selected waterfowl species, have been assigned priority status.

The protected dunes of Island Beach State Park, in particular the Southern Natural Area are nesting and foraging habitat for beach nesting birds and shorebirds, including American oystercatcher, black skimmer, least tern, and piping plover. This area could also provide habitat

1 **Figure 8.** Critical landscape habitats within the Barnegat Bay - Little Egg Harbor conservation
 2 zone, as identified through the Landscape Map (v2).



for the reintroduction of the northeastern beach tiger beetle. Marsh islands, including some dredge spoil sites provide significant nesting habitat for colonial waterbirds, black skimmer, and common tern. Tidal marshes are foraging habitat for coastal marsh birds and northern diamondback terrapin. Marsh habitat, in particular in the Sedge Island WMA provide critical nesting habitat for osprey and peregrine falcon, while the Eastern box turtle, Cope's gray treefrog, and Fowler's toad inhabit upland forests and wetlands. Marine mammals, sea turtles, and some species of anadromous fish utilize estuarine habitat, including inlets and bays. Harbor seals also use sandy beaches and sand bars just inside Barnegat Inlet as winter "haul-out" locations. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Barnegat Bay – Little Egg Harbor Zone

Table C30. Federal Endangered and Threatened Species*

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle			X	X
Piping plover		X		
Roseate tern		X	X	
Reptiles				
Bog turtle			X	
Green sea turtle ♦	X			
Hawksbill sea turtle ♦	X			
Kemp's ridley sea turtle ♦	X			
Leatherback sea turtle ♦	X			
Loggerhead sea turtle ♦	X			
Insects				
Northeastern beach tiger beetle		R		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦ Sea turtles only present in water (inlets, bays, and estuaries).

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

Table C31. State Endangered Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American bittern			X	
Black skimmer		X	X	
Least tern		X		
Northern harrier			X	X
Peregrine falcon			X	
Pied-billed grebe			X	
Sedge wren			X	
Short-eared owl			X	X
Amphibians				
Cope's gray treefrog			X	

X: Species occurs within the identified habitat.

Table C32. State Threatened Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
Black rail			X	
Black-crowned night heron			X	X

State Threatened Species (continued)

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds (continued)				
Osprey		X	X	
Red knot		X	X	
Yellow-crowned night heron			X	X

X: Species occurs within the identified habitat.

Table C33. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Harbor porpoise	X			
Harbor seal ♦	X	X		
Marsh rice rat			X	
Southern bog lemming			X	X
Birds				
American golden-plover			X	
American oystercatcher		X	X	
Black tern		X		
Caspian tern		X		
Cattle egret			X	
Chimney swift				X
Common barn owl				X
Common tern		X	X	
Forster's tern			X	
Glossy ibis			X	
Great blue heron				X
Great crested flycatcher				X
Great egret			X	
Greater yellowlegs			X	
Green heron			X	X
Gull-billed tern		X	X	
Horned lark		X		
Hudsonian godwit			X	
King rail			X	
Least bittern			X	
Little blue heron			X	
Marbled godwit			X	
Marsh wren			X	
Nelson's sharp-tailed sparrow			X	
Purple sandpiper		X		
Royal tern		X		
Ruddy turnstone		X	X	
Saltmarsh sharp-tailed sparrow			X	
Sanderling		X	X	
Seaside sparrow			X	
Semipalmated sandpiper		X	X	
Snowy egret			X	
Tricolored heron			X	
Whimbrel			X	
Willet		X	X	
Wilson's phalarope		X	X	
Reptiles				
Eastern box turtle				X
Northern diamondback terrapin		X	X	
Amphibians				
Fowler's toad		X		
Fish				
Atlantic sturgeon	X			

♦ Harbor seal primarily present in water, but utilize beach as "haul-outs".

X: Species occurs within the identified habitat.

Table C34. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American black duck	X		X	
Atlantic brant	X		X	
Black scoter	X			
Bufflehead	X		X	
Canada goose (Atlantic population)	X		X	
Canvasback	X		X	
Clapper rail			X	
Common eider *	X			
Greater scaup	X		X	
Harlequin duck*	X			
Lesser scaup	X		X	
Long-tailed duck	X			
Northern pintail	X		X	
Surf scoter	X			
Virginia rail			X	
White-winged scoter	X			

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jetties each winter, but this is insignificant to the overall population status.

X: Species occurs within the identified habitat.

Table C35. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table C36. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJ DFW to be species of concern.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
River otter	X		X	
Birds				
Sora rail			X	

X: Species occurs within the identified habitat

c. Threats to the Wildlife and Habitats

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Narrow, steep beaches with little dune system, which are characteristic of Long Beach Island, the major barrier island in the zone, provide limited suitable nesting habitat for beach nesting birds. Intensive dune management, including overuse of dune fencing and unnecessary beach grass planting (i.e. where adequate storm protection already exists), exacerbates the poor quality of the habitat. A major beach replenishment project planned for the island could create more suitable habitat, but municipal management of the beach would have to be closely monitored to ensure

that activities, such as mechanical beach raking, don't jeopardize nesting opportunities or nesting success and/or reduces available foraging habitat for piping plovers and migratory shorebirds. Intense off-road vehicle usage on Island Beach State Park severely degrades oceanfront beach habitat for beach nesting birds and northeastern beach tiger beetles. Development of remaining coastal scrub-shrub and forested habitat reduces habitat critical for migratory raptors, songbirds and butterflies. Stabilization and manipulation of the Barnegat Inlet (e.g. jetties, revetment, geotubes, ongoing dredging, etc.) reduces natural formation of habitat, creates impediments or reduction of foraging and nesting opportunities for some species (piping plovers, northern diamondback terrapin). Invasive plant species, such as phragmites, which dominate many dredge disposal sites and some coastal salt marshes, reduce the suitability of habitat for critical coastal species, including breeding long-legged wading birds, high marsh specialists, and waterfowl. The impacts of aquaculture, particularly for hard clams (*Mercenaria mercenaria*), as well as hydraulic crab dredging are largely unmeasured and poorly understood.

Heavy recreational use of all beaches on Long Beach Island (exception: Borough of Barnegat Light) limits nesting opportunities and potential success for beach nesting birds and also creates disturbance to a wide range of migrating shorebirds. Off-road vehicle use on the oceanfront portion of Island Beach State Park, particularly the southern end, creates on-going disturbance that strongly reduces the likelihood of beach nesting birds selecting the site to nest, and causes disturbance to migratory (foraging) shorebirds. Boats and personal watercraft create disturbance at back-bay colonial waterbird colonies and osprey nests, and interfere with foraging throughout the region.

Excessive predation, especially by human subsidized species (e.g. red fox, crow, gull species, raccoon, striped skunk, free-roaming "owned" or feral cats), severely impairs beach nesting bird and colonial waterbirds breeding success. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect critical habitats identified by the Landscape Project.
- Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone.
- Reduce and mitigate the negative effects of beach nourishment projects on beach nesting birds and their habitat.
- Modify local beach management practices to reduce their adverse effects on beach nesting birds.
- Reduce the adverse impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality.
- Continue to monitor and protect osprey and peregrine falcon.
- Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish species in the Barnegat Bay – Little Egg Harbor Zone.
- Preserve populations of endangered, threatened, and special concern fishes.
- Conduct investigations to improve understanding of habitat needs of critical wildlife species.

- Reduce incremental loss of remaining scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species.
- Identify areas where additional habitat-based regulatory measures or land acquisition would be appropriate to benefit wildlife.
- Pursue habitat restoration or enhancement where it would benefit wildlife.
- Improve marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl.
- Reduce deleterious effects of pesticides on coastal species and ecosystems.
- Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat.
- Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets.
- Protect beach nesting bird sites and associated foraging habitats from human disturbance.
- Reduce the impacts of human disturbance on colonial nesting birds.
- Protect overwintering colonies and/or “haul out” areas for harbor seals.
- Reduce excessive predation on beach nesting birds, colonial waterbirds, and other species.
- Reduce mortality of northern diamondback terrapin.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Assess feasibility of reintroduce of northeastern beach tiger beetle to appropriate beach sites.
- Identify critical wildlife habitat to protect or buffer to accommodate sea-level change.
- Develop and promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical beach/dune, coastal scrub-shrub, forest, and wetland habitats and assess their condition for nesting, migrating, and wintering birds, and other coastal species. Maintain information and incorporate all new survey and mapping data into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land use regulation, municipal and regional planning, land acquisition priorities and development of management and conservation strategies. (<i>Protect habitat – Landscape Project</i>)
1°	Develop, review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available, including species or species groups (e.g. waterfowl) not currently integrated. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)

Priority	Conservation Actions (continued)
Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone	
1°	Develop or update management plans through N.J. Division of Parks and Forestry for state parks and natural areas, including Barnegat Lighthouse State Park and Island Beach State Park. Ensure that they have a strong beach nesting bird management component, where appropriate. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Develop a management plan through N.J. Bureau of Land Management for Manahawkin WMA that is consistent with the overall conservation goals of the zone. (<i>Protect habitat – Landscape Project</i>)
1°	Review Comprehensive Management Plan for Edwin B. Forsythe NWR to coordinate long-range planning goals and strategies, especially with regards to development of their Habitat Management Plan. (<i>Protect habitat – Landscape Project</i>)
Reduce and mitigate negative impacts of beach nourishment for beach nesting birds	
1°	Develop and implement beach management agreements with municipalities on Long Beach Island as island-wide replenishment is scheduled for the near future. Develop agreement with Borough of Barnegat Light regardless of status of replenishment project as piping plovers already nest on their beach. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Continue to coordinate with U.S. Army Corps of Engineers (USACE), NJDEP Office of Engineering and Construction (OEC) and Land Use Regulation Program (LURP) to reduce impacts on nesting success of beach nesting birds. (<i>Conserve wildlife – rare wildlife</i>)
1°	Continue to work with USACE to integrate designs into beach nourishment projects that increase availability of and access to nesting and foraging habitat, in particular at beaches adjacent to Barnegat Inlet. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate experimental techniques to improve foraging habitat on nourished beaches. (<i>Conserve wildlife – rare wildlife</i>)
Modify local beach management practices to reduce impacts to beach nesting birds	
1°	Work with U.S. Department of Agriculture (USDA) – Natural Resources Conservation Services (NRCS), U.S. Fish and Wildlife Service (USFWS), USACE, and NJDEP LURP to develop best management practices, including dune management policies, to incorporate into beach nesting bird management agreements. (<i>Other practices – land management</i>)
1°	Incorporate limits on beach raking practices into beach nesting bird management agreements. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
Reduce impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality	
1°	Eliminate or reduce phragmites from dredge material sites to allow for the natural succession of woody habitats to benefit nesting long-legged wading birds or create sandy substrate for ground nesting colonial waterbirds at selected sites. “Jump-start” natural vegetation (using nursery stock and seedlings) where appropriate. <i>(Conserve wildlife – rare wildlife, invasives)</i>
1°	Develop and implement best management practices to address adverse effects of both invasive plant and wildlife species (e.g. phragmites, mute swan) and over-abundant native wildlife (e.g. resident Canada geese, greater snow goose) on quality of coastal wetland habitat. <i>(Conserve wildlife – invasives; Other practices – land management)</i>
1°	Assess impacts of gull populations (laughing gull, greater black-back gull, herring gull) on breeding success of beach nesting birds, colonial waterbirds, and other species to determine if integrated wildlife damage management of gulls is necessary. <i>(Conserve wildlife –, subsidized predators)</i>
1°	Monitor encroachment of Japanese sedge in beach/dune habitat and assess impacts on habitat quality. Implement control efforts at Island Beach State Park where it is already well established and at other sites where appropriate. <i>(Evaluate restoration – invasives)</i>
Monitor and protect osprey and peregrine falcon	
1°	Maintain nesting opportunities through repair and replacement of existing man-made structures. Identify where additional nesting structures would be appropriate. <i>(Conserve wildlife – rare wildlife)</i>
1°	Continue regular monitoring of all known pairs of peregrine falcon, including assessment of productivity and threats. Track other regularly observed birds to determine new nesting pairs/sites. <i>(Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife)</i>
1°	Continue regular monitoring of osprey, including coast wide survey of population and nesting success on biannual basis, and annual assessment of reproductive success at targeted locations, such as Sedge Islands WMA. <i>(Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife)</i>
1°	Monitor levels of heavy metals and other contaminants, especially Mercury, in eggs, adults and young, to determine effects on reproductive success. <i>(Conserve wildlife – contaminants)</i>
1°	Continue to monitor fish stocks, in particular menhaden, to determine effects of reduced or changing prey base on reproductive success of osprey. <i>(Monitor wildlife – long-term monitoring)</i>

1

Priority	Conservation Actions (continued)
Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish	
1°	Increase frequency of coast wide aerial colonial waterbirds surveys to once every other year to better determine population trends and distribution. Continue critical investigation of aerial survey technique through selected “ground truthing” and literature and peer review in order to increase efficacy of survey, minimize surveyor bias and error, and increase accuracy of trend data. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
1°	Continue intensive monitoring of populations and reproductive success of beach nesting birds, including piping plover, least tern, black skimmer, common tern and American oystercatcher. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
2°	Continue surveys of wintering population of American oystercatcher. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
1°	Determine reproductive success of colonial waterbirds at targeted nesting colonies. Identify factors limiting success, including predators and possible effects of contaminants. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife, contaminants</i>)
1°	Increase understanding of migratory songbird distribution and habitat use by conducting surveys or reviewing existing databases to better identify specific migratory songbird species using coastal habitat, as well as distribution of species. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Conduct surveys to determine distribution, population, and habitat use of coastal marsh birds, in particular high marsh specialists, such as Northern harrier, black rails and salt marsh sharp-tailed sparrow. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
1°	Continue the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Protect habitat – migratory birds; Conserve wildlife – game species</i>)
1°	Continue the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – game species</i>)
2°	Conduct baseline inventory of coastal mammal species, including marsh rice rat and southern bog lemming. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
Preserve populations of endangered, threatened, and special concern fishes	
1°	Map distributions of special concern fish species, and integrate those data into the Landscape Project’s habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Conserve wildlife – rare wildlife; Protect habitat – fish</i>)

1

Priority	Conservation Actions (continued)
Conduct investigations to improve understanding of habitat needs of critical wildlife species	
1°	Pursue investigations of comparative reproductive success of American oystercatcher and common terns on beach vs. marsh nesting habitat at selected sites, including identification of specific threats. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate habitat selection of breeding colonial waterbirds, including use of phragmites. (<i>Protect habitat – Landscape Project</i>)
1°	Research population distribution of northern diamondback terrapin to determine critical areas for protection. (<i>Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring</i>)
1°	Conduct research to quantify importance of shrub-scrub habitat for migratory songbirds. (<i>Protect habitat – migratory birds</i>)
1°	Investigate carrying capacity of back bay habitats for wintering greater and lesser scaup. (<i>Conserve wildlife – game species</i>)
1°	Investigate the role of locally available contaminants in the ecology of greater and lesser scaup. (<i>Conserve wildlife – contaminants; Conserve wildlife – game species</i>)
1°	Investigate impacts of aquaculture on waterfowl and other wildlife. (<i>Aquaculture – land management; Conserve wildlife – game species</i>)
1°	Investigate carrying capacity of coastal salt marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Investigate impacts of hydraulic crab dredging on back-bay habitats and wildlife. (<i>Protect habitat – humans</i>)
1°	Investigate home ranges of wintering Atlantic brant in relation to carrying capacity of back-bay habitat for Atlantic brant. (<i>Conserve wildlife – game species</i>)
Reduce loss of scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species	
1°	Identify remaining parcels of scrub-shrub habitat and forest patches and protect through either application of Coastal Zone Management (CZM) “critical wildlife habitat” designation or acquisition. (<i>Protect habitat – Landscape Project, migratory birds</i>)
Identify areas where additional habitat-based regulatory protection or land acquisition would be appropriate.	
1°	Assess effectiveness of current designation of Sedge Islands WMA as a Marine Conservation Zone and determine if additional measures are needed to insure adequate protection of its wildlife and habitat. Implement appropriate changes. (<i>Protect habitat – Landscape Project</i>)
1°	Acquire or facilitate acquisition of land adjacent to the Edwin B. Forsythe NWR and Manahawkin WMA to fill critical gaps in public land holdings or buffer existing holdings. (<i>Protect habitat – Landscape Project; Corridors – sprawl</i>)
1°	Pursue acquisition or landowner agreements/easements to protect remaining private marsh islands. (<i>Protect habitat – Landscape Project</i>)

1

Priority	Conservation Actions (continued)
Pursue habitat restoration or enhancement where it would benefit wildlife	
1°	Restore or enhance nesting and foraging habitat for beach nesting birds, including piping plovers, least terns, black skimmers, common terns, and American oystercatchers on the south side of the Barnegat Inlet. Restoration would include reduction of mature dunes and dense beach vegetation to create more suitable nesting habitat, and creation of tidally-flushed pond for improving foraging habitat. (<i>Conserve wildlife – rare wildlife</i>)
1°	Reduce state regulatory impediments to improving habitat for beach nesting birds and coastal marsh species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify locations where undoing the effects of wetland ditching can benefit marsh species, especially high marsh or area-sensitive species, such as northern harriers. Implement restoration of these sites. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Continue to work with NJDEP-OEC, USACE, and other appropriate agencies to coordinate beneficial placement of dredge materials for creation, enhancement, or maintenance of colonial waterbird nesting, in particular with regards to Intercoastal Waterway restoration projects. Develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
2°	Identify coastal marsh islands within Barnegat Bay where the lack sufficient wrack mats limits nesting for black skimmer and common terns. Create “artificial” nesting mats through raking and redistribution of wrack material. (<i>Conserve wildlife – rare wildlife</i>)
1°	Reestablish or restore submerged aquatic vegetation beds in critical areas where they formerly occurred in order to benefit waterfowl species. (<i>Conserve wildlife – game species</i>)
Improve marsh management techniques to benefit critical wildlife species	
1°	Conduct critical assessment of effects of Open Marsh Water Management on wildlife species, in particular high marsh nesting birds and waterfowl. Modify best management practices as appropriate. (<i>Conserve wildlife – rare wildlife, game species; Other practices – land management</i>)
Reduce deleterious effects of pesticides on coastal species and ecosystems	
1°	Support and conduct investigations assessing the impacts of pesticides and biological controls on coastal species, in particular those species dependent on coastal marshes and wetlands. Modify best management practices as appropriate. (<i>Other practices – land management</i>)
Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat	
1°	Continue to provide information to local, state, and federal agencies involved in emergency oil spill response, including assessments of impacts on critical natural resources during and after spill events. Update guidance documents used by agencies to develop strategies to plan for and reduce impacts of oil spill. (<i>Protect habitat – oil</i>)

Priority	Conservation Actions (continued)
Reduce human disturbance to red knots and other migratory shorebirds	
1°	Identify important staging areas, determine and enforce the necessary restrictions on human activities. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans; Corridors – migratory birds</i>)
1°	Notify the NJ Division of Fish and Wildlife’s Bureau of Law Enforcement of critical sites to implement stringent enforcement of endangered species laws including harassment and human disturbance. (<i>Protect habitat – humans</i>)
Protect beach nesting bird sites and foraging habitat from human disturbance	
1°	Continue existing management practices that minimize impacts of human disturbance (e.g. fence, post and patrol nesting sites). Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Establish a protected (fenced) nesting area on the oceanfront portion of the southern end of Island Beach State Park. Regulate off-road vehicle usage as necessary to protect birds that nest in the area. (<i>Protect habitat – humans</i>)
1°	Incorporate enforcement of pet restriction regulations into beach nesting bird plans and agreements. Strengthen law enforcement of no pet restrictions by state conservation officers and park rangers. (<i>Protect habitat – humans</i>)
1°	Develop targeted outreach towards pet owners. (<i>Education- humans</i>)
1°	Increase regular presence of state conservation officers at beach nesting bird sites. (<i>Protect habitat – humans</i>)
Reduce impacts of human disturbance on colonial nesting birds	
1°	Reduce watercraft impacts on colonial waterbirds: Identify important foraging areas and habitats and establish, post, and enforce buffers to restrict watercraft and pedestrian use around nesting areas. Elicit assistance from staff of Edwin B. Forsythe NWR to implement on refuge lands. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Conduct investigations to establish appropriate buffer sizes to minimize disturbance from watercraft and pedestrians. (<i>Protect habitat – humans</i>)
Protect overwintering colonies and/or “haul out” areas for harbor seals	
2°	Identify and post important “haul-out” areas (e.g. Barnegat Inlet) to minimize human disturbance. (<i>Protect habitat – humans</i>)
Reduce excessive predation on beach nesting birds, colonial waterbirds, other species	
1°	Continue existing management practices to reduce predation on beach nesting birds, including techniques such as predator exclosures and electric fence. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Conduct integrated wildlife damage management at important nesting sites for beach nesting birds (Island Beach State Park) and colonial waterbirds, especially focusing on feral cats and red fox. (<i>Conserve wildlife – cats, subsidized predators</i>)

1

Priority	Conservation Actions (continued)
1°	Work with local municipalities to develop policies and/or establish regulations that minimize the impacts of predators on native wildlife species, including bans on feeding of wildlife and bans on “managed” cat colonies near critical wildlife areas. <i>(Conserve wildlife – cats, subsidized predators)</i>
Reduce mortality of northern diamondback terrapin	
1°	Close the harvest season for northern diamondback terrapin. <i>(Conserve wildlife – rare wildlife)</i>
1°	Identify key crossing areas and work with local or state transportation agencies to erect turtle barriers. <i>(Protect habitat – roads)</i>
1°	Determine compliance with current crab trap regulations (e.g. turtle excluder devices) and increase enforcement if necessary. <i>(Conserve wildlife – rare wildlife)</i>
1°	Investigate if current regulations are sufficient. <i>(Conserve wildlife – rare wildlife)</i>
Identify and protect summer bat habitat and migratory corridors	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
1°	Assess significance of coastal region as an important travel corridor and concentration site for migratory tree bats. <i>(Protect habitat – Landscape Project)</i>
1°	Evaluate and assess impacts of wind turbines to populations of bats. <i>(Protect habitat – humans)</i>
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat. <i>(Protect habitat – Landscape Project; Conserve wildlife – rare wildlife)</i>
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). <i>(Conserve wildlife – rare wildlife)</i>
Assess feasibility of reintroduce of northeastern beach tiger beetle at appropriate beach sites	
2°	Conduct pilot study and/or collaborate with USFWS to identify locations at Island Beach State Park appropriate for reintroduction of northeast beach tiger beetle and gauge likelihood of success of reintroduction efforts. <i>(Conserve wildlife – rare wildlife)</i>
Identify areas to protect to accommodate sea-level change	
2°	Work with Rutgers University’s Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping to identify areas along the coast that need protection and/or buffering in the event of significant sea-level rise. <i>(Protect habitat – Landscape Project)</i>

1

Priority	Conservation Actions (continued)
Promote public education and awareness	
1°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
1°	Create viewing opportunities for beach nesting birds at Barnegat Lighthouse State Park and Island Beach State Park, and for colonial water birds at selected appropriate locations. (<i>Education – humans</i>)
1°	Encourage and develop opportunities for eco-tourism in the coastal zone. (<i>Education – humans</i>)
1°	Present educational programs to local environmental organizations and community groups to promote understanding of threats to beach nesting, colonial water birds, osprey, and for other coastal species as needed, and to increase environmental stewardship. (<i>Education – humans</i>)
1°	Work with New Jersey Division of Parks and Forestry (NJDPF) to develop and enhance outreach opportunities with regards to beach nesting birds at state parks and natural areas, such as Barnegat Lighthouse State Park and Island Beach State Park. (<i>Education – humans</i>)
1°	Develop public education materials addressing the impacts of invasive non-indigenous species on native wildlife and habitat quality. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)
2°	Develop outreach brochure about diamondback terrapin biology, behavior and threats, specifically targeting recreational (crab pot) crabbers. (<i>Education – humans</i>)
2°	Develop outreach materials for watercraft users, including mapping component to identify critical feeding and nesting habitats to avoid. (<i>Education – humans</i>)

2

3 **f. Potential Partnerships to Deliver Conservation**

4 Private Landowners

- 5 • Work with private landowners to maintain or create scrub-shrub habitat for migratory
- 6 songbirds, raptors and butterflies through promotion of “backyard habitat” program.
- 7 • Encourage private owners of dredge material islands to create or enhance habitat suitable for
- 8 colonial nesting birds through landowner incentive programs.
- 9 • Develop and implement landowner incentives for providing, maintaining, and protecting
- 10 summer bat habitat.

11

12 Public

- 13 • Expand volunteer Citizen Scientist Program recruitment and activities.
- 14 ○ Collaborate with conservation groups such as NJ Audubon Society, local land trusts, The
- 15 Nature Conservancy – NJ Chapter, and NJ Conservation Foundation, and other

- environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
- Recruit Citizen Scientists and conservation groups to assist with surveying and monitoring of wildlife, including colonial waterbirds, ospreys, peregrine falcons, and migratory shorebirds and songbirds.
 - Involve Citizen Scientists in management and protection projects, such as fencing beach nesting bird breeding sites, erection and placement of osprey nesting platforms, and other appropriate projects.

Wildlife Professionals

- Collaborate with researchers and wildlife managers from other Atlantic coast states to develop best management practices, conservation plans, and surveying protocol for colonial waterbirds, beach nesting birds, and other coastal species.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Elicit assistance from New Jersey Audubon Society, in particular through coordinated Citizen Scientist Program, to assist in various bird surveys.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds of conservation need.
- Work with conservation organization such as New Jersey Audubon Society, American Bird Conservancy, and Cats Indoors! to develop advocacy for appropriate conservation and regulatory issues.
- Work with the Tuckerton Seaport, Barnegat Bay Estuary Program, Save Barnegat Bay, and others to coordinate conservation efforts and develop outreach opportunities, in particular with regards to watershed and water quality issues in Barnegat Bay.
- Encourage the use of Landscape Project critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Academic Institutions

- Collaborate with Richard Stockton College's Coastal Research Center to develop comparisons of manipulated and natural beach systems that can be used to develop a scientific model to identify suitable beach nesting bird micro-habitats, which can be incorporated into beach fill project designs.
- Work with Richard Stockton College to develop appropriate projects for internship program.
- Work with Rutgers University to develop appropriate graduate level research projects in the coastal area, in particular focusing on beach nesting birds, colonial waterbirds, and American oystercatcher.
- Work with Rutgers University Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping of areas that will be potentially impacted by sea-level rise.
- Collaborate with other US and Canadian universities on migration and wintering ecology of waterfowl and other birds of conservation need.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, NRCS, USFWS - NJ Field Office, US Army Corps. of Engineers (USACE), and USDA, non-profit organizations, and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats, and to protect populations of coastal species.
 - Municipalities, NJ Department of Environmental Protections Division's (DEP) of Fish and Wildlife (DFW) and Parks and Forestry (DPF), the State Wildlife Control Unit, USDA-APHIS-Wildlife Services, and local animal control officers to work together to reduce the effects of predators, especially red fox and feral cats, on beach nesting birds and other critical wildlife.
 - DFW and conservation organizations to develop stronger partnerships with municipal environmental commissions to gain support for local conservation efforts, in particular involving beach nesting birds.
 - DFW to create habitat and implement best management practices for coastal marsh birds and migratory songbirds and raptors on Wildlife Management Areas.
 - DFW to work with the U.S. Army Corps of Engineers (USACE) and state dredging programs to create and maintain habitat for nesting colonial waterbirds.
 - DFW to coordinate development and implementation of beach nesting bird management plans with USFWS, NJDPF and local municipalities.
 - DFW to work with the USFWS and the USACE, to ensure that beachfill and beach renourishment projects include a beach nesting bird component.
 - DFW, USFWS, USACE, NJ-OCE, DEP's Land Use Regulation Program (LURP), and USDA-Natural Resources Conservation Service (NRCS) to work together to develop dune management policies and techniques that benefit beach nesting birds, while still providing adequate storm protection.
 - Where feasible, continue to shift some responsibilities for management of beach nesting birds to individual municipalities and other agencies (e.g. NJDPF at Island Beach State Park).
 - DFW and conservation organizations to work with appropriate local, county, and state road departments to reduce road mortality to northern diamondback terrapins, in particular in areas identified as having high density populations or high incidence of mortality.
 - DFW to continue protection measures for northern diamondback terrapins by requiring excluders on commercial crab traps in small creeks and lagoons.
 - DFW and local municipalities to limit public access and disturbance to colonial waterbird breeding colonies, increase presence at beach nesting bird breeding sites, and continue to strongly enforce Sedge Islands Marine Conservation Zone.
 - DFW to work with state and county mosquito commissions to assess the impacts of insecticides and biological controls on critical wildlife, and improve best management practices for marsh management.
 - DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
 - DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.

- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with the Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, conservation organizations, and land stewards to work with NJ Coastal Heritage Trail to develop more wildlife focused trail destinations or viewing areas, and to elevate the importance of eco-tourism.
- DFW to work with NJDEP-OEC, USACE, and other appropriate agencies to develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach nesting and coastal marsh birds, and the importance of the Atlantic Flyway and its associated migratory stopover sites.
- DFW to work with Ocean County Park System to develop outreach programs and wildlife viewing opportunities.
- DFW and conservation organizations to expand public outreach through on-site programs, programs at the Lighthouse Camp, and colonial waterbird viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, local land trusts, and through mitigation.
- DEP to encourage the use of Landscape Project critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time.
- Monitor efficacy of habitat management, habitat restoration, and invasive species control projects.
- Continue to annually monitor abundance, productivity, distribution, and trends of breeding piping plovers, black skimmers, least terns, common terns, American oystercatchers (beach nesting population only), osprey (biennial), peregrine falcons, colonial waterbirds (biennial),

1 as well as wintering waterfowl and migratory shorebird communities. Conduct threat
2 assessment including factors relating to nest failure and brood loss.

- 3 • Collect baseline data (distribution and abundance) for other coastal species, such as marsh
4 birds, migratory songbirds and raptors, northern diamondback terrapins, and coastal
5 mammals including bats.
- 6 • Conduct Delphi Process every three to four years to update status of coastal species.

5. Northern Atlantic Coastal

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring success*

a. Habitats

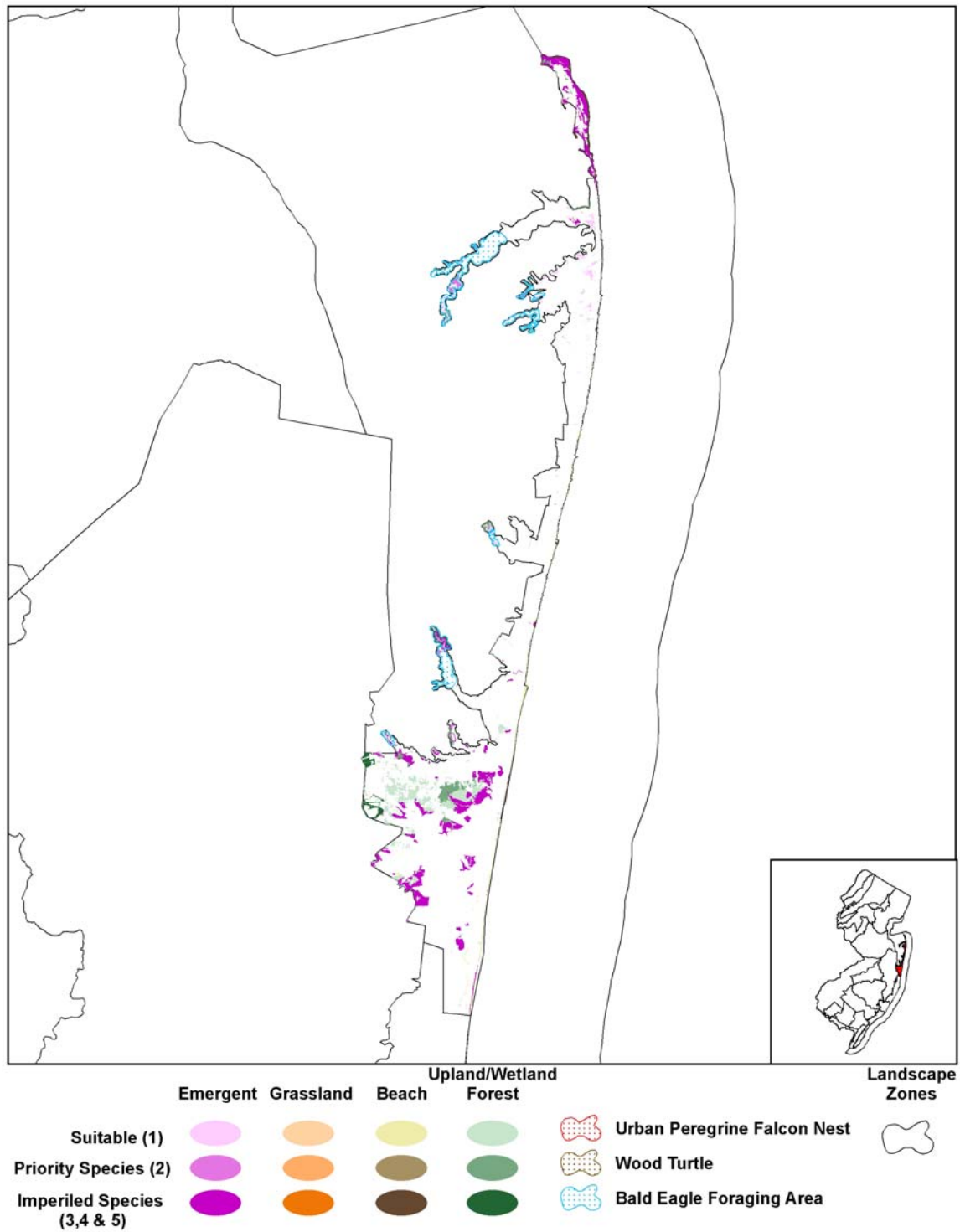
The Northern Atlantic Coastal zone spans the eastern edge of northern Ocean County and Monmouth County, encompassing the narrow strip of beach and dunes along the ocean and extending west into the tidal portions of several rivers, including the Metedeconk, Manasquan, Shark, Shrewsbury and Navesink (Figure 9). Nearly the entire strand of beach (excluding portions of the Sandy Hook Unit of Gateway National Recreation Area) is subject to ongoing beach renourishment projects and has a manmade feature (boardwalk, bulkheading, seawall, roadway) directly behind the beach instead of a natural dune system. Sandy Hook, located at the northernmost tip of the coast, still has a largely intact vegetated dune community, scrub-shrub and natural beach habitat. The zone also includes the northern section of Barnegat Bay and its adjacent tidal salt meadows and marshes, shallow inlets and coves, upland pitch pine and oak forests. With the exception of the Barnegat Bay portion, the northern coastal zone is distinctly different from coastal zones to the south because of the lack of barrier islands – most of the northern coast is not separated from the mainland (Piedmont Plain) by a body of water.

The most important conservation area of opportunity in the Northern Atlantic Coastal zone is the Sandy Hook Unit of Gateway National Recreation Area (including the “resident” U.S. Coast Guard Base). Other important areas include isolated bayside sections of the Edwin B. Forsythe NWR (Barnegat Division), primarily in the vicinity of the Metedeconk River, Swan Point Natural Area, and a portion of the Manasquan River WMA. Several county parks, including Cattus Island and Gull Island in Ocean County and Seven President’s Oceanfront Park in Monmouth County, provide habitat for a variety of coastal species. Wetlands and islands within all of the major river systems also provide valuable foraging or nesting habitat for a variety of species.

b. Wildlife of Greatest Conservation Need

The Northern Atlantic Coastal zone supports nine federal endangered or threatened species, five state endangered species, four state threatened species, and 41 species of special concern or regional priority. The federal endangered or threatened species are the piping plover, bald eagle, northeastern beach tiger beetle (reintroduction candidate), as well as sea turtle species that may enter the region’s inlets, bays and rivers. In addition, summer populations of bats, potentially including the federal endangered Indiana bat, are suspected to occur in the zone. The five state endangered species are the American bittern, black skimmer, least tern, northern harrier, and peregrine falcon. The four state threatened species are the black-crowned night-heron, osprey, red knot, and yellow-crowned night heron. Among the special concern wildlife are American oystercatchers, common terns, various species of herons and egrets, northern diamondback terrapins, and Fowler’s toads. Back bay salt marshes and coastal sounds in this area are important wintering areas for Atlantic brant and American black ducks in the Atlantic Flyway. Waters of the Navesink and Shrewsbury rivers are significant wintering areas for greater and

1 **Figure 9.** Critical landscape habitats within the Northern Atlantic Coastal conservation zone, as
 2 identified through the Landscape Map (v2).



lesser scaup. Other game species, most notably selected waterfowl species, have been assigned priority status.

The beaches of Sandy Hook provide important nesting habitat for piping plovers, least terns, common terns, and American oystercatchers, foraging habitat for migrating shorebirds, and habitat for reintroduction of northeastern beach tiger beetles. Sandy Hook also provides nesting habitat for ospreys and its scrub-scrub and maritime forest provides critical stopover and foraging habitat for migrating songbirds and raptors. Marsh islands in the northern Barnegat Bay provide nesting habitat for black skimmers and common terns, as well as some colonial waterbirds. Peregrine falcons utilize man-made towers erected along Barnegat Bay for nesting, and although not a confirmed breeder in the northernmost portion of the zone, they have been regularly observed during the breeding season. Tidal portions of the rivers provide nesting and/or foraging habitat for bald eagles and ospreys, as well as habitat for northern diamondback terrapins. Marine mammals, sea turtles, and some species of anadromous fish sometimes utilize estuarine habitat, including inlets, bays, and rivers. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Northern Atlantic Coastal Zone

Table C37. Federal Endangered and Threatened Species*

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle			X	X
Piping plover		X		
Reptiles				
Green sea turtle ♦	X			
Hawksbill sea turtle ♦	X			
Kemp's ridley sea turtle ♦	X			
Leatherback sea turtle ♦	X			
Loggerhead sea turtle ♦	X			
Insects				
Northeastern beach tiger beetle		R		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦ Sea turtles only present in water (inlets, bays, estuaries).

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

Table C38. State Endangered Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American bittern			X	
Black skimmer		X	X	
Least tern		X		
Northern harrier			X	X
Peregrine falcon			X	

X: Species occurs within the identified habitat.

Table C39. State Threatened Species

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
Black-crowned night heron			X	X
Osprey		X	X	
Red knot		X	X	
Yellow-crowned night heron			X	X

X: Species occurs within the identified habitat.

Table C40. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
Harbor porpoise	X			
Harbor seal ♦	X	X		
Marsh rice rat			X	
Southern bog lemming			X	X
Birds				
American golden-plover			X	
American oystercatcher		X	X	
Black tern		X		
Caspian tern		X		
Cattle egret			X	
Chimney swift				X
Common barn owl				X
Common tern		X	X	
Glossy ibis			X	
Great blue heron				X
Great crested flycatcher				X
Great egret			X	
Greater yellowlegs			X	
Green heron			X	X
Gull-billed tern		X	X	
Horned lark		X		
Hudsonian godwit			X	
Least bittern			X	
Little blue heron			X	
Marbled godwit			X	
Marsh wren			X	
Nelson's sharp-tailed sparrow			X	
Purple sandpiper		X		
Royal tern		X		
Ruddy turnstone		X	X	
Saltmarsh sharp-tailed sparrow			X	
Sanderling		X	X	
Seaside sparrow			X	
Semipalmated sandpiper		X	X	
Snowy egret			X	
Tricolored heron			X	
Whimbrel			X	
Willet		X	X	
Wilson's phalarope		X	X	
Reptiles				
Northern diamondback terrapin		X	X	
Amphibians				
Fowler's toad		X		
Fish				
Atlantic sturgeon	X			

♦ Harbor seal primarily present in water, but utilize beach as "haul-outs".

X: Species occurs within the identified habitat.

Table C41. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Birds				
American black duck	X		X	
Atlantic brant	X		X	
Black scoter	X			
Bufflehead	X		X	
Canada goose (Atlantic population)	X		X	
Canvasback	X		X	
Clapper rail			X	
Common eider *	X			
Greater scaup	X		X	
Harlequin duck*	X			
Lesser scaup	X		X	
Long-tailed duck	X			
Northern pintail	X		X	
Surf scoter	X			
Virginia rail			X	
White-winged scoter	X			

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jetties each winter, but this is insignificant to the overall population status.

X: Species occurs within the identified habitat.

Table C42. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table C43. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beach	Wetlands	Forests and Forested Wetlands
Mammals				
River otter	X		X	
Birds				
Sora rail			X	

X: Species occurs within the identified habitat

c. Threats to the Wildlife and Habitats

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Lack of suitable beach habitat limits opportunities for beach nesting birds except in the northernmost portion of this zone, and intensive dune management, including overuse of dune fencing and unnecessary beach grass planting (i.e. where adequate storm protection already exists), further reduces habitat suitability. Mechanical beach raking on virtually all beaches (exceptions: National Guard Training Center, portions of the Boroughs of Monmouth Beach and Sea Bright and Gateway National Recreation Area - Sandy Hook Unit) reduces available

foraging habitat for piping plovers and migratory shorebirds and poses risks to unfledged piping plover and least tern chicks. The coastal zone is nearly completely developed, except for some critical areas along the rivers and at Sandy Hook, resulting in little remaining scrub-shrub and forested habitat critical for migratory raptors, songbirds and butterflies, as well as nesting colonial waterbirds. Invasive plant species, including phragmites, which reduce the suitability of wetland habitat, and Japanese sedge, which severely impairs natural communities and desirability of beach and dune habitat, are a threat throughout the region.

Beach nourishment projects create otherwise suitable habitat in areas of high human use, increasing impacts of human disturbance on beach nesting birds. Intensive recreational use of virtually all beaches (with the exception of portions of Gateway National Recreation Area – Sandy Hook Unit and Borough of Sea Bright) severely impacts nesting success for beach nesting birds and also creates disturbance to a wide range of migrating shorebirds. Lax enforcement of local “no-dogs-on-beach” ordinances on nearly all beaches creates severe disturbance of beach nesting birds, with resultant impacts on nesting success. Boats and personal watercraft disturb at back bay and river colonial waterbird colonies and osprey nests, and interfere with foraging throughout the region. The impacts of aquaculture, particularly for hard clams (*Mercenaria mercenaria*) as well as hydraulic crab dredging, are largely unmeasured and poorly understood.

Excessive predation, especially by human subsidized species (e.g. red fox, crow, gull species, raccoon, striped skunk, free-roaming “owned” or feral cats), severely impairs beach nesting bird and colonial waterbirds breeding success. Because there are no barrier islands to impede mammalian predator access to beach areas and because much of this zone is a year-round residential area, human-induced predator effects are particularly acute in this zone. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect critical habitats identified by the Landscape Project.
- Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone.
- Reduce and mitigate the negative effects of beach nourishment projects on beach nesting birds and their habitat.
- Modify local beach management practices to reduce their adverse effects on beach nesting birds.
- Reduce the adverse impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality.
- Continue to monitor and protect osprey and peregrine falcon.
- Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish species in the Northern Atlantic Coastal Zone.
- Preserve populations of endangered, threatened, and special concern fishes.
- Conduct investigations to improve understanding of habitat needs of critical wildlife species.
- Reduce incremental loss of remaining scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species.
- Pursue habitat restoration or enhancement where it would benefit wildlife.

- Improve marsh management techniques to benefit critical wildlife species, in particular high marsh nesting birds and waterfowl.
- Reduce deleterious effects of pesticides on coastal species and ecosystems.
- Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat.
- Reduce the impacts of human disturbance on red knots and other migratory shorebirds that use the intertidal zone of beaches and inlets.
- Protect beach nesting bird sites and associated foraging habitats from human disturbance.
- Reduce the impacts of human disturbance on colonial nesting birds.
- Protect overwintering colonies and/or “haul out” areas for harbor seals.
- Reduce excessive predation on beach nesting birds, colonial waterbirds, and other species.
- Reduce mortality of northern diamondback terrapin.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Reintroduce northeastern beach tiger beetle to appropriate beach sites.
- Identify critical wildlife habitat to protect or buffer to accommodate sea-level change.
- Develop and promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical beach/dune, coastal scrub-shrub, forest, and wetland habitats and assess their condition for nesting, migrating, and wintering birds, and other coastal species. Maintain information and incorporate all new survey and mapping data into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land use regulation, municipal and regional planning, land acquisition priorities and development of management and conservation strategies. (<i>Protect habitat – Landscape Project</i>)
1°	Develop, review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available, including species or species groups (e.g. waterfowl) not currently integrated. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)
Ensure that management plans for federal and state lands within the zone are coordinated with and implemented to achieve the overall goals of the zone	
1°	Work with Gateway National Recreation Area – Sandy Hook Unit to coordinate long-range planning goals and strategies, in particular to ensure that development and/or recreational activities fully address potential threats to wildlife and habitat.

1

Priority	Conservation Actions (continued)
1°	Review Comprehensive Management Plan for Edwin B. Forsythe NWR to coordinate long-range planning goals and strategies, especially with regards to development of their Habitat Management Plan. (<i>Protect habitat – Landscape Project</i>)
Reduce and mitigate negative impacts of beach nourishment for beach nesting birds	
1°	Develop and implement beach management agreements with municipalities, especially the Boroughs of Sea Bright and Monmouth Beach where significant breeding populations of beach nesting birds are already present. Work with other agencies/landowners (National Guard Training Center, Monmouth County Park System) to ensure that a beach nesting bird component is included in management plans for their beach sites. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Continue to coordinate with U.S. Army Corps of Engineers (USACE), NJDEP Office of Engineering and Construction (OEC) and Land Use Regulation Program (LURP) to reduce impacts on nesting success of beach nesting birds. (<i>Conserve wildlife – rare wildlife</i>)
1°	Continue to work with USACE to integrate designs into beach nourishment projects that increase availability of and access to nesting and foraging habitat. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate experimental techniques to improve foraging habitat on nourished beaches. (<i>Conserve wildlife – rare wildlife</i>)
Modify local beach management practices to reduce impacts to beach nesting birds	
1°	Work with U.S. Department of Agriculture (USDA) – Natural Resources Conservation Services (NRCS), U.S. Fish and Wildlife Service (USFWS), USACE, and NJDEP LURP to develop best management practices, including dune management policies, to incorporate into beach nesting bird management agreements. (<i>Other practices – land management</i>)
1°	Incorporate limits on beach raking practices into beach nesting bird management agreements. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
Reduce impacts of invasive exotic and over-abundant native species on critical wildlife, natural communities, and habitat quality	
1°	Eliminate or reduce phragmites from dredge material sites to allow for the natural succession of woody habitats to benefit nesting long-legged wading birds or create sandy substrate for ground nesting colonial waterbirds at selected sites. “Jump-start” natural vegetation (using nursery stock and seedlings) where appropriate. (<i>Conserve wildlife – rare wildlife, invasives</i>)
1°	Develop and implement best management practices to address adverse effects of both invasive plant and wildlife species (e.g. phragmites, mute swan) and over-abundant native wildlife (e.g. resident Canada geese, greater snow goose) on quality of coastal wetland habitat, including coastal ponds. (<i>Conserve wildlife – invasives; Other practices – land management</i>)

1

Priority	Conservation Actions (continued)
1°	Assess impacts of gull populations (laughing gull, greater black-back gull, herring gull) on breeding success of beach nesting birds, colonial waterbirds, and other species to determine if integrated wildlife damage management of gulls is necessary. (<i>Conserve wildlife – invasives</i>)
1°	Monitor encroachment of Japanese sedge in beach/dune habitat and assess impacts on habitat quality. Implement control efforts at Sandy Hook Unit of Gateway National Recreation Area where it is already well established and at other sites where appropriate. (<i>Evaluate restoration – invasives</i>)
Monitor and protect ospreys and peregrine falcons	
1°	Maintain nesting opportunities through repair and replacement of existing man-made structures. Identify where additional nesting structures would be appropriate. (<i>Conserve wildlife – rare wildlife</i>)
1°	Continue regular monitoring of all known pairs of peregrine falcon, including assessment of productivity and threats. Track other regularly observed birds to determine new nesting pairs/sites. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
1°	Continue regular monitoring of osprey, including coast wide survey of population and nesting success on biannual basis, and annual assessment of reproductive success at several targeted locations. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Monitor levels of heavy metals and other contaminants, especially Mercury, in eggs, adults and young, to determine effects on reproductive success. (<i>Conserve wildlife – contaminants</i>)
1°	Continue to monitor fish stocks, in particular menhaden, to determine effects of reduced or changing prey base on reproductive success of osprey. (<i>Monitor wildlife – long-term monitoring</i>)
Inventory and monitor beach nesting birds, colonial waterbirds, and other endangered, threatened, special concern, and regional priority wildlife and fish	
1°	Continue intensive monitoring of populations and reproductive success of beach nesting birds, including piping plovers, least terns, black skimmers, common terns, and American oystercatchers. (<i>Monitor wildlife – long-term monitoring, Conserve wildlife – rare wildlife</i>)
1°	Determine reproductive success of colonial waterbirds at targeted nesting colonies. Identify factors limiting success, including predators and possible effects of contaminants. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife, contaminants</i>)
1°	Increase frequency of coast-wide aerial colonial waterbirds surveys to once every other year to better determine population trends and distribution. Continue critical investigation of aerial survey technique through selected “ground truthing” and literature and peer review in order to increase efficacy of survey, minimize surveyor bias and error, and increase accuracy of trend data. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Increase understanding of migratory songbird distribution and habitat use by conducting surveys or reviewing existing databases to better identify specific migratory songbird species using coastal habitat, as well as distribution of species. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife; Protect habitat – migratory birds)</i>
1°	Conduct surveys to determine distribution, population, and habitat use of coastal marsh birds, in particular high marsh specialists, such as northern harriers, black rails, and salt marsh sharp-tailed sparrows. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
1°	Continue the annual Mid-Winter Waterfowl Survey. <i>(Monitor wildlife – long-term monitoring; Protect habitat – migratory birds; Conserve wildlife – game species)</i>
1°	Continue the Atlantic Flyway Breeding Waterfowl Survey. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – game species)</i>
2°	Conduct baseline inventory of coastal mammal species, including the marsh rice rat and southern bog lemming. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
Preserve populations of endangered, threatened, and special concern fishes	
1°	Map distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. <i>(Monitor wildlife – fish; Protect habitat – Landscape Project)</i>
1°	Develop and implement management actions to enhance populations of special concern and rare fish. <i>(Conserve wildlife – rare wildlife; Protect habitat - fish)</i>
Conduct investigations to improve understanding of habitat needs of critical wildlife species	
1°	Pursue investigations of comparative reproductive success of American oystercatcher and common terns on beach vs. marsh nesting habitat at selected sites, including identification of specific threats. <i>(Conserve wildlife – rare wildlife)</i>
1°	Investigate habitat selection of breeding colonial waterbirds, including use of phragmites. <i>(Protect habitat – Landscape Project)</i>
1°	Research population distribution of northern diamondback terrapins to determine critical areas for protection. <i>(Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring)</i>
1°	Conduct research to quantify importance of shrub-scrub habitat for migratory songbirds. <i>(Protect habitat – migratory birds)</i>
1°	Investigate carrying capacity of back-bay habitats for wintering greater and lesser scaup. <i>(Conserve wildlife – game species)</i>
1°	Investigate the role of locally available contaminants in the ecology of greater and lesser scaup. <i>(Protect habitat – contaminants; Conserve wildlife – game species)</i>
1°	Investigate impacts of aquaculture on waterfowl and other wildlife. <i>(Aquaculture – land management; Conserve wildlife – game species)</i>

1

Priority	Conservation Actions (continued)
1°	Investigate carrying capacity of coastal salt marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Investigate impacts of hydraulic crab dredging on back-bay habitats and wildlife. (<i>Protect habitat – humans</i>)
1°	Investigate home ranges of wintering Atlantic brant in relation to carrying capacity of back bay habitat for Atlantic brant. (<i>Conserve wildlife – game species</i>)
Reduce loss of scrub-shrub habitat and forest patches in order to benefit migratory songbirds, raptors, butterflies, and other species	
1°	Identify remaining parcels of scrub-shrub habitat and forest patches and protect through either application of Coastal Zone Management (CZM) “critical wildlife habitat” designation or acquisition. (<i>Protect habitat – Landscape Project, migratory birds</i>)
Pursue habitat restoration or enhancement where it would benefit wildlife	
1°	Continue to work with NJDEP-OEC, USACE, and other appropriate agencies to coordinate beneficial placement of dredge materials for creation, enhancement, or maintenance of colonial waterbird nesting. Develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Reduce state regulatory impediments to improving habitat for beach nesting birds. (<i>Conserve wildlife – rare wildlife</i>)
1°	Reestablish or restore submerged aquatic vegetation beds in critical areas where they formerly occurred in order to benefit waterfowl species. (<i>Conserve wildlife – game species</i>)
Improve marsh management techniques to benefit critical wildlife species	
1°	Conduct critical assessment of effects of Open Marsh Water Management (near northern end of Barnegat Bay) on wildlife species, in particular high marsh nesting birds and waterfowl. Modify best management practices as appropriate. (<i>Conserve wildlife – rare wildlife, game species; Other practices – land management</i>)
Reduce deleterious effects of pesticides on coastal species and ecosystems	
1°	Support and conduct investigations assessing the impacts of pesticides and biological controls on coastal species, in particular those species dependent on coastal marshes and wetlands. Modify best management practices as appropriate. (<i>Other practices – land management</i>)
Assess, reduce and mitigate effects of oil spills on critical coastal wildlife and habitat	
1°	Continue to provide information to local, state, and federal agencies involved in emergency oil spill response, including assessments of impacts on critical natural resources during and after spill events. Update guidance documents used by agencies to develop strategies to plan for and reduce impacts of oil spill. (<i>Protect habitat – oil</i>)

1

Priority	Conservation Actions (continued)
Reduce human disturbance to red knot and other migratory shorebirds	
1°	Identify important staging areas, determine and enforce the necessary restrictions on human activities. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans; Corridors – migratory birds</i>)
1°	Notify the NJ Division of Fish and Wildlife’s Bureau of Law Enforcement of critical sites to implement stringent enforcement of endangered species laws including harassment and human disturbance. (<i>Protect habitat – humans</i>)
Protect beach nesting bird sites and foraging habitat from human disturbance	
1°	Continue existing management practices that minimize impacts of human disturbance (e.g. fence, post and patrol nesting sites). Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Incorporate enforcement of pet restriction regulations into beach nesting bird plans and agreements. Strengthen law enforcement of no-pet restrictions by state conservation officers and park rangers. (<i>Protect habitat – humans</i>)
1°	Develop targeted outreach towards pet owners. (<i>Education – humans</i>)
1°	Increase regular presence of state conservation officers at beach nesting bird sites. (<i>Protect habitat – humans</i>)
Reduce impacts of human disturbance on colonial nesting birds	
1°	Reduce watercraft impacts on colonial waterbirds: Identify important foraging areas and habitats and establish, post, and enforce buffers to restrict watercraft and pedestrian use around nesting areas. Obtain any necessary approvals from New Jersey Tidelands Council for management actions. (<i>Protect habitat – humans</i>)
1°	Conduct investigations to establish appropriate buffer sizes to minimize disturbance from watercraft and pedestrians. (<i>Protect habitat – humans</i>)
Protect overwintering colonies and/or “haul out” areas for harbor seals	
2°	Identify and post important “haul-out” areas to minimize human disturbance. (<i>Protect habitat – humans</i>)
Reduce excessive predation on beach nesting birds, colonial waterbirds, other species	
1°	Continue existing management practices to reduce predation on beach nesting birds, including techniques such as predator exclosures and electric fence. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Conduct integrated wildlife damage management at important nesting sites for beach nesting birds and colonial waterbirds, especially focusing on feral cats and red fox. Reduction of fox predation at the Sandy Hook Unit of Gateway National Recreation Area is a top priority, as this site is critical for piping plover recovery in the state. (<i>Conserve wildlife – cats, subsidized predators</i>)
1°	Work with local municipalities to develop policies and/or establish regulations that minimize the impacts of predators on native wildlife species, including bans on feeding of wildlife and bans on “managed” cat colonies near critical wildlife areas. (<i>Conserve wildlife – cats, subsidized predators</i>)

1

Priority	Conservation Actions (continued)
Reduce mortality of northern diamondback terrapins	
1°	Close the harvest season for northern diamondback terrapins. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify key crossing areas and work with local or state transportation agencies to erect turtle barriers. (<i>Protect habitat – roads</i>)
1°	Determine compliance with current crab trap regulations (e.g. turtle excluder devices) and increase enforcement if necessary. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate if current regulations are sufficient. (<i>Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat and migratory corridors	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Assess significance of coastal region as an important travel corridor and concentration site for migratory tree bats. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Reintroduce northeastern beach tiger beetles to appropriate beach sites	
1°	Work with USFWS and National Park Service to implement reintroduction of northeastern beach tiger beetles at Sandy Hook Unit of Gateway National Recreation Area. (<i>Conserve wildlife – rare wildlife</i>)
Identify areas to protect to accommodate sea-level change	
2°	Work with Rutgers University's Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping to identify areas along the coast that need protection and/or buffering in the event of significant sea-level rise. (<i>Protect habitat – Landscape Project</i>)
Promote public education and awareness	
1°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
1°	Create viewing opportunities for beach nesting birds at Sandy Hook Unit of Gateway National Recreation Area, and for colonial water birds at selected appropriate locations. (<i>Education – humans</i>)
1°	Encourage and develop opportunities for eco-tourism in the coastal zone. (<i>Education – humans</i>)

1

Priority	Conservation Actions (continued)
1°	Present educational programs to local environmental organizations and community groups to promote understanding of threats to beach nesting, colonial water birds, ospreys, and for other coastal species as needed, and to increase environmental stewardship. (<i>Education – humans</i>)
1°	Develop public education materials addressing the impacts of invasive non-indigenous species on native wildlife and habitat quality. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)
2°	Develop outreach brochure about diamondback terrapin biology, behavior and threats, specifically targeting recreational (crab pot) crabbers. (<i>Education – humans</i>)
2°	Develop outreach materials for watercraft users, including mapping component to identify critical feeding and nesting habitats to avoid. (<i>Education – humans</i>)

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3 **f. Potential Partnerships to Deliver Conservation**

4 Private Landowners

- 5 • Work with private landowners to maintain or create scrub-shrub habitat for migratory
- 6 songbirds, raptors and butterflies through promotion of “backyard habitat” program.
- 7 • Encourage private owners of dredge material islands to create or enhance habitat suitable for
- 8 colonial nesting birds through landowner incentive programs.
- 9 • Develop and implement landowner incentives for providing, maintaining, and protecting
- 10 summer bat habitat.

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12 Public

- 13 • Expand volunteer Citizen Scientist Program recruitment and activities.
 - 14 ○ Collaborate with conservation groups such as NJ Audubon Society, local land trusts, The
 - 15 Nature Conservancy–NJ Chapter, and NJ Conservation Foundation, and other
 - 16 environmental, member-based organizations to recruit and train Citizen Scientists to
 - 17 locate, survey, and monitor wildlife habitats and populations in a systematic manner to
 - 18 achieve short and long term monitoring goals.
 - 19 ○ Recruit Citizen Scientists and conservation groups to assist with surveying and
 - 20 monitoring of wildlife, including colonial waterbirds, ospreys, peregrine falcons, and
 - 21 migratory shorebirds and songbirds.
 - 22 ○ Involve Citizen Scientists in management and protection projects, such as fencing beach
 - 23 nesting bird breeding sites, erection and placement of osprey nesting platforms, and other
 - 24 appropriate projects.

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Wildlife Professionals

- Collaborate with researchers and wildlife managers from other Atlantic coast states to develop best management practices, conservation plans, and surveying protocol for colonial waterbirds, beach nesting birds, and other coastal species.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Elicit assistance from New Jersey Audubon Society (Sandy Hook Bird Observatory and membership in general), in particular through coordinated Citizen Scientist Program, to assist in various bird surveys.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds of conservation need.
- Work with conservation organization such as New Jersey Audubon Society (especially Sandy Hook Bird Observatory), Monmouth County Audubon Society, American Bird Conservancy, and Cats Indoors! to develop advocacy for appropriate conservation and regulatory issues.
- Continue to work with the Wreck Pond Watershed Association to gain assistance with beach nesting bird management and to assist with outreach and advocacy efforts in the local communities.
- Encourage the use of Landscape Project critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Academic Institutions

- Collaborate with Richard Stockton College's Coastal Research Center to develop comparisons of manipulated and natural beach systems that can be used to develop a scientific model to identify suitable beach nesting bird micro-habitats, which can be incorporated into beach fill project designs.
- Continue Monmouth University Intern Program to assist in management and protection of beach nesting birds in the Monmouth County region.
- Work with Rutgers University to develop appropriate graduate level research projects in the coastal area, in particular focusing on beach nesting birds and colonial waterbirds.
- Work with Rutgers University Center for Remote Sensing and Spatial Analysis to develop predictive modeling and GIS mapping of areas that will be potentially impacted by sea-level rise.
- Collaborate with other US and Canadian universities on migration and wintering ecology of waterfowl and other birds of conservation need.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USFWS - NJ Field Office, US Army Corps. of Engineers (USACE), USDA, non-profit organizations, Department of Community Affairs (DCA), and Office of Smart Growth to protect, enhance, and create habitats and to protect populations of coastal species.

- Municipalities, NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) and Parks and Forestry (DPF), the State Wildlife Control Unit, USDA-APHIS-Wildlife Services, and local animal control officers to work together to reduce the effects of predators, especially red foxes and feral cats, on beach nesting birds and other critical wildlife.
- DFW and conservation organizations to develop stronger partnerships with municipal environmental commissions to gain support for local conservation efforts, in particular involving beachnesting birds.
- DFW to coordinate development and implementation of beach nesting bird management plans with USFWS, NJDPF and local municipalities.
- DFW to work with the USFWS and the USACE, to ensure that beach fill and beach renourishment projects include a beach nesting bird component.
- Where feasible, continue to shift some responsibilities for management of beach nesting birds to individual municipalities and other agencies, as has already been achieved at Seven President's Oceanfront Park (Monmouth Co. Park System).
- DFW and conservation organizations to work with appropriate local, county, and state road departments to reduce road mortality to diamondback terrapins, in particular in areas identified as having high-density populations or high incidence of mortality.
- DFW to continue protection measures for northern diamondback terrapins by requiring excluders on commercial crab traps in small creeks and lagoons.
- DFW and local municipalities to limit public access and disturbance to colonial waterbird breeding colonies and increase presence at beach nesting bird breeding sites.
- DFW to work with state and county mosquito commissions to assess the impacts of insecticides and biological controls on critical wildlife, and improve best management practices for marsh management.
- DFW and conservation organizations to work with Ocean and Monmouth County Park Systems to develop outreach programs, enhance wildlife viewing opportunities, and assist with stewardship of park lands to best benefit wildlife.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.

- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with the Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, conservation organizations, and land stewards to work with NJ Coastal Heritage Trail to develop more wildlife focused trail destinations or viewing areas, and to elevate the importance of eco-tourism.
- DFW to work with NJDEP-OEC, USACE, and other appropriate agencies to develop and implement best management practices for making dredge spoil deposition sites attractive to breeding, migrating and wintering wildlife.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach nesting and coastal marsh birds, and the importance of the Atlantic Flyway and its associated migratory stopover sites.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and colonial waterbird viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, local land trusts, and through mitigation.
- DEP to encourage the use of Landscape Project critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time.
- Monitor efficacy of habitat management, habitat restoration, and invasive species control projects.
- Continue to annually monitor abundance, productivity, distribution, and trends of breeding piping plovers, black skimmers, least terns, common terns, American oystercatchers (beach nesting population only), ospreys (biennial), peregrine falcons, colonial waterbirds (biennial), as well as wintering waterfowl and migratory shorebird communities. Conduct threat assessment including factors relating to nest failure and brood loss.
- Collect baseline data (distribution and abundance) for other coastal species, such as marsh birds, migratory songbirds and raptors, diamondback terrapins, and coastal mammals including bats.
- Conduct Delphi Process every three to four years to update status of coastal species.

6. The Atlantic Ocean

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring success*

a. Habitats

The Atlantic Ocean is marine habitat extending from the coasts of Monmouth, Ocean, Atlantic and Cape May counties extending out to the 3-mile limit under state jurisdiction (Figure 10).

b. Wildlife of Greatest Conservation Need

The Atlantic Ocean supports 11 federal endangered or threatened species and three suites of special concern or regional priority wildlife. The federal endangered wildlife species include blue, fin, humpback, right, sei, and sperm whales, hawksbill sea turtle, Kemp's ridley sea turtle, green sea turtle, and leatherback sea turtle. Loggerhead sea turtle, which is state endangered, is the federal threatened species. The Atlantic sturgeon is a federal species of concern. Some pinnipeds (harbor seals), porpoises (harbor porpoises), pelagic birds (including true pelagics and near-shore migrants), and anadromous fish species (Hickory shad) are suites of wildlife of special concern or regional priority. Tables C44 – C47 identify the species of greatest conservation need within this zone.

1 **Figure 10.** Critical landscape habitats within the Atlantic Ocean conservation zone, as identified
 2 through the Landscape Map (v2).



Wildlife Species of the Atlantic Ocean Zone

Table C44. Federal Endangered and Threatened Species*

Common Name	Ocean
Mammals	
Blue whale	X
Fin whale	X
Humpback whale	X
Right whale	X
Sei whale	X
Sperm whale	X
Reptiles	
Green sea turtle	X
Hawksbill sea turtle	X
Leatherback sea turtle	X
Loggerhead sea turtle	X
Kemp's ridley sea turtle	X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

X: Species occurs within the identified habitat.

Table C45. Nongame Species of Conservation Concern

Common Name	Ocean
Mammals	
Harbor porpoise	X
Harbor seal	X
Birds	
Audubon's shearwater	X
Bridled tern	X
Greater shearwater	X
Horned grebe	X
Manx shearwater	X
Northern gannet	X
Razorbill	X
Red-throated loon	X
Fish	
Atlantic sturgeon	X

X: Species occurs within the identified habitat.

Table C46. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Ocean
Birds	
Black scoter	X
Common eider*	X
Harlequin duck*	X
Long-tailed duck	X
Surf scoter	X
White-winged scoter	X

*Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jettys each winter, but this is insignificant to the overall population status.

X: Species occurs within the identified habitat.

Table C47. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Ocean
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

c. Threats to Wildlife in the Atlantic Ocean

Whale, sea turtle, pinniped, and seabird populations are threatened by many commercial fishing practices, including long lines and gill nets. Sea turtles, pinnipeds and especially whales are susceptible to ship strikes. Atlantic sturgeon are threatened by habitat loss/degradation and commercial fishing practices, such as gillnetting for monkfish and dogfish sharks. Threats to seabirds are less well known as abundance, distribution, and usage patterns within state waters have not been studied extensively. Oil spills, in particular large events which always loom as a threat because of the large amount of oil routinely transported to ports in the Delaware River near Philadelphia and New York Harbor area, have potentially serious short and long-term impacts on all marine species. Proposed offshore wind energy projects may also be a threat to species using the marine environment, in particular seabirds and migratory birds. The impacts of aquaculture, particularly for hard clams (*Mercenaria mercenaria*), as well as hydraulic crab dredging, are largely unmeasured and poorly understood. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Assess distribution and status of blue, fin, humpback, right, sei, and sperm whales in New Jersey waters, including determination of right whale migration routes.
- Protect migrating whales, sea turtles, and seabirds.
- Reduce negative fisheries interactions for marine mammals, sea turtles, seabirds and Atlantic sturgeon.
- Preserve populations of endangered, threatened, and special concern fishes.
- Monitor population of and threats to Atlantic bottlenose dolphins and harbor porpoises.
- Assess distribution, abundance, usage patterns and needs of seabird species, including true pelagics and near-shore migrants (e.g. seaducks, red-throated loons) that use state water on a seasonal basis.
- Assess threats of offshore wind energy projects, especially on seabirds and migrating bird species.
- Assess, reduce and mitigate effects of oil spills on critical marine wildlife and habitat.
- Identify acoustic threats to marine mammal species and work to minimize impacts.
- Assess status of selected marine and estuarine fishes through the Delphi Process.
- Promote public education and increase awareness of New Jersey’s indigenous nongame fish species.

e. Conservation Actions

Priority	Conservation Actions
Assess distribution of whales, determine right whale migration routes	
1°	Conduct surveys in shipping lane vicinities and along the coast during whale migration, particularly for right whales. (<i>Monitor wildlife - long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Determine right whale migration routes off NJ using predictive GIS model based on available occurrence information and habitat data. (<i>Protect habitat – Landscape Project, Conserve wildlife – rare wildlife</i>)
1°	Participate in the East Coast’s Sightings Advisory System for mariners. (<i>Monitor wildlife - long-term monitoring</i>)

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Priority	Conservation Actions (continued)
1°	Increase or initiate monitoring programs for species where present data is insufficient. (<i>Protect habitat – Landscape Project</i>)
Protect migrating whales, sea turtles, and seabirds	
1°	Identify the threats facing whales, pinnipeds, porpoises and sea turtles including ship strikes and commercial fishing gear. (<i>Protect aquatic wildlife – humans</i>)
1°	Conduct workshop to determine, through expert opinion, the conservation needs of NJ's marine mammals and sea turtles. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement conservation plans specific to New Jersey waters for whales, pinnipeds, seabirds (consistent with the North American Waterbird Conservation Plan), and sea turtles. (<i>Conserve wildlife – rare wildlife</i>)
1°	Increase or initiate monitoring programs for species where present data is insufficient. (<i>Monitor wildlife - long-term monitoring</i>)
2°	Develop opportunities for Atlantic Ocean wildlife eco-tourism. (<i>Education – humans</i>)
Preserve populations of endangered, threatened, and special concern fishes	
1°	Map distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Conserve wildlife – rare wildlife; Protect habitat - fish</i>)
Reduce negative fisheries interactions for all species listed in zone	
1°	Reduce “by-catch” of listed and other critical species through regulatory or volunteer measures. (<i>Protect aquatic wildlife – humans</i>)
1°	Investigate impacts to Atlantic sturgeon from commercial fishing practices. (<i>Protect aquatic wildlife – humans</i>)
Monitor Atlantic bottlenose dolphin and harbor porpoise populations and threats	
1°	Use existing data to develop database of population abundance and distribution. (<i>Monitor wildlife - long-term monitoring</i>)
1°	Assess threats and determine health of population through research and from expert opinion. (<i>Conserve wildlife – rare wildlife</i>)
1°	Initiate regular surveying and/or monitoring, if deemed necessary. (<i>Monitor wildlife - long-term monitoring</i>)
Assess distribution, abundance and usage patterns of seabirds (near-shore migrants and pelagic birds)	
1°	Use existing survey data (NJAS SeaWatch, SeaNet Beach Bird Surveys) to develop database of species present and their distribution. Initiate additional survey efforts to gain better understanding of usage patterns. (<i>Monitor wildlife - long-term monitoring</i>)
1°	Develop and implement a reliable survey for measuring the populations and/or trends of near-shore water birds of conservation need. (<i>Monitor wildlife - long-term monitoring</i>)
1°	Establish criteria to protect species through regulatory measures. (<i>Conserve wildlife – rare wildlife</i>)

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Priority	Conservation Actions (continued)
Assess threat of offshore wind energy projects on marine species	
1°	Initiate or work with other agencies or organizations to assist with research of effects of offshore energy projects on avian species and marine mammals. (<i>Protect aquatic wildlife – humans</i>)
Assess, reduce and mitigate effects of oil spills on critical marine wildlife and habitat	
1°	Continue to provide information to local, state, and federal agencies involved in emergency oil spill response, including assessments of impacts on critical natural resources during and after spill events. Update guidance documents used by agencies to develop strategies to plan for and reduce impacts of oil spill. (<i>Protect habitat – oil</i>)
Identify acoustic threats to marine mammals species and work to minimize impacts	
1°	Investigate sound sources off the NJ coast to three miles, determine potential threats, and incorporate plan to minimize impacts into a marine mammal protection strategy. (<i>Protect aquatic wildlife – humans</i>)
Assess status of selected marine and estuarine fishes through the Delphi Process	
1°	Conduct Delphi Process on marine and estuarine fishes, recommend status changes to DEP Commissioner, and if warranted establish legal status through rule making process. Based on Delphi process results, recommend fish species for Federal “Species of Concern” program to National Oceanic and Atmospheric Administration (NOAA) Fisheries. (<i>Status – fish</i>)
Promote public education and awareness	
2°	Develop public education materials to increase awareness of New Jersey’s indigenous nongame fish species. (<i>Education – humans</i>)

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3 f. Potential Partnerships to Deliver Conservation

4 Public

- 5 • Expand volunteer Citizen Scientist Program recruitment and activities.
 - 6 ○ Recruit volunteers through Citizen Scientist Program or other conservation organizations
 - 7 to participate in the Seabird Ecological Assessment Network’s (SEANET) beached bird
 - 8 surveys.
 - 9 ○ Identify other projects where Citizen Scientist Program could assist with surveying and
 - 10 monitoring of marine species.

11

12 Commercial and Recreational Fishermen

- 13 • Enlist the support of commercial and recreational fishermen in identifying whales and
- 14 pelagic birds in New Jersey waters.
- 15 • Enlist commercial and recreation fishermen, along with members of the Garden State
- 16 Seafood Association, to serve as reviewers in the Delphi Process.

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Conservation Organizations

- Work with the Marine Mammal Stranding Center, Riverhead Foundation, and other stranding organizations to participate in marine mammal/sea turtle conservation workshop and identify conservation needs.
- Work with New Jersey Audubon Society to improve our understanding of pelagic bird species, possibly by expanding their current survey efforts of near-shore migrants, which consists of an annual fall survey (from land) at one location. Coordinate efforts to assess threats of wind energy projects.
- Continue to work with the Wildlife Trust (and Tufts University) which has implemented a Seabird Ecological Assessment Network (SEANET) for New Jersey that includes beached bird surveys at targeted locations along the coast, development of a seabird database, and identification of causes of bird mortality.

Academic Institutions

- Work with Rutgers University, including Center for Coastal and Marine Studies, to identify conservation needs and initiate (or continue) research projects as appropriate.
- Work with Rutgers University, Richard Stockton College of NJ and other academic institutions to participate in the marine mammal/sea turtle conservation workshop and identify conservation needs.
- Continue to work with Tufts University (through SEANET) to identify causes of mortality of pelagic seabirds.
- Enlist experts from Rutgers University, Richard Stockton College of NJ and other academic institutions to serve as reviewers in the Delphi Process.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies to protect, enhance, and create habitats and to protect populations of marine mammals, sea turtles, near-shore and pelagic birds, and Atlantic sturgeon.
 - NJ Department of Environmental Protection's Division of Fish and Wildlife (DFW), US Fish and Wildlife Service (USFWS)–NJ Field Office, and National Oceanic and Atmospheric Administration (NOAA) Fisheries to work together to implement recovery plans.
 - DFW, NOAA Fisheries, and other marine experts to collaborate in a workshop to identify conservation needs of marine mammals, reptiles, birds, and fish.
 - DFW to collaborate with USFWS, Atlantic Flyway Council, and Atlantic Coast Joint Venture to develop and implement an operational sea duck and near-shore bird survey for species of conservation need.
 - DFW to identify important pinniped areas.
 - DFW and NOAA Fisheries to investigate the impacts of fisheries gear interactions (including by-catch) on marine mammals, sea turtles, pelagic birds and Atlantic sturgeon.
 - DFW and NOAA Fisheries to determine acoustic threats to marine mammals.
 - DFW and the National Marine Fisheries Industry to develop guidelines and/or regulations to reduce by-catch of marine mammal, sea turtles, and pelagic birds.
 - DFW to expand efforts to develop materials for eco-tourism.

- DFW and NOAA Fisheries, and Mid-Atlantic Fishery Management Council to conduct Delphi Process.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with federal and state agencies, including USFWS, USCG, NOAA, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration, to plan for and assist with emergency oil spill response.

g. Monitoring Success

- Monitor populations and abundance of whales, pinnipeds, sea turtles, and near-shore and pelagic birds of conservation need.
- Determine if by-catch of critical species is reduced.
- Conduct Delphi Process every three to four years to update status of marine species.

Delaware Bay Landscape

Contents of the Chapter on the Delaware Bay Landscape

- A. *Ecological Units in the Delaware Bay Landscape*
- B. *Geology and Climate*
- C. *Habitats*
- D. *Wildlife of Greatest Conservation Need*
- E. *Threats to Wildlife and Habitats of the Delaware Bay Landscape Region*
- F. *Conservation Zones, Assessments, and Strategies*
 - 1. *Cohansey River*
 - a. *Habitats*
 - b. *Wildlife of Greatest Conservation Need*
 - c. *Threats to Wildlife and Associated Habitats*
 - d. *Conservation Goals*
 - e. *Conservation Actions*
 - f. *Potential Partnerships to Deliver Conservation*
 - g. *Monitoring Success*
 - 2. *Maurice River Watershed*
 - 3. *Tuckahoe River Watershed*
 - 4. *Delaware Bay Shoreline*
 - 5. *Cape May Peninsula*

This landscape includes Cumberland, Cape May, and southern Atlantic counties and parallels the coastline of the Delaware Bay and the Cape May Peninsula, from Oyster Cove to Great Egg Harbor. The Delaware Bay and the Cohansey, Maurice, and Tuckahoe Rivers are the most prominent aquatic features of this landscape. The region may be divided into five zones: Cohansey River, Maurice River, Tuckahoe River, Delaware Bay shoreline, and Cape May peninsula. The boundaries of these zones were determined first by general habitat types and second by watershed (HUC 14) lines. The shoreline zone was defined to generally follow the woodline between marsh and upland habitats.

A. Ecological Units in the Delaware Bay Landscape

The Delaware Bay Landscape is within the Middle Atlantic Coastal Plain Section and crosses the southern extent of both the New Jersey Inner Coastal Plain (232Ac) and New Jersey Outer Coastal Plain (232Ab) subsections.

B. Geology and Climate

The Delaware Bay Landscape is within the Coastal Plain physiographic province. The landscape gently rises from the Delaware Bay and the Atlantic Ocean coastlines to 36 meters (118 ft.) above sea level. The average temperature across the New Jersey Inner and Outer Coastal Plain subsections is between 10.5 to 12.2°C (51 to 54°F) and the growing season varies from 180 to 225 days. The average annual precipitation is between 101.6 and 116.8 centimeters (40 to 46 in.).

C. Habitats

This landscape is bordered on the east by the expansive salt marsh between the mainland and the Atlantic Ocean barrier islands, to the northeast by the Pinelands, and on the west by the Delaware Bay (Figure 11). The upland forests and forested wetlands of the Delaware Bay Landscape (100,886 hectares, 389.5 sq. mi.) include pitch pine, oaks, black cherry, and sweet gum. These forests, particularly in the Cape May peninsula, support the majority of New Jersey's neotropical birds. The wetlands of Delaware Bay (33,897 hectares, 130.8 sq. mi.) include extensive saltwater marshes. The sandy overwash beaches (312 hectares, 1.2 sq. mi.) are a critical stopover for migrating shorebirds. There are agricultural lands as well, producing lettuce, peppers, tomatoes, cabbage, and soybeans on much of the 28,798 hectares (111.1 sq. mi.) of grasslands, which are not necessarily suitable habitats for grassland species. Similarly, scrub/shrub habitat is included in the "forest" and "forested wetlands" habitats on the Landscape Maps. Federal, state agencies, and nonprofit conservation organizations own and manage a large percentage of the Delaware Bay landscape. This region has the highest concentration of rare and endangered wildlife in New Jersey, accompanied by the lowest density of urban development in the state. The Delaware Bay Landscape is a region of global importance and offers considerable opportunities for conservation.

Conservation Zones in the Delaware Bay region are:

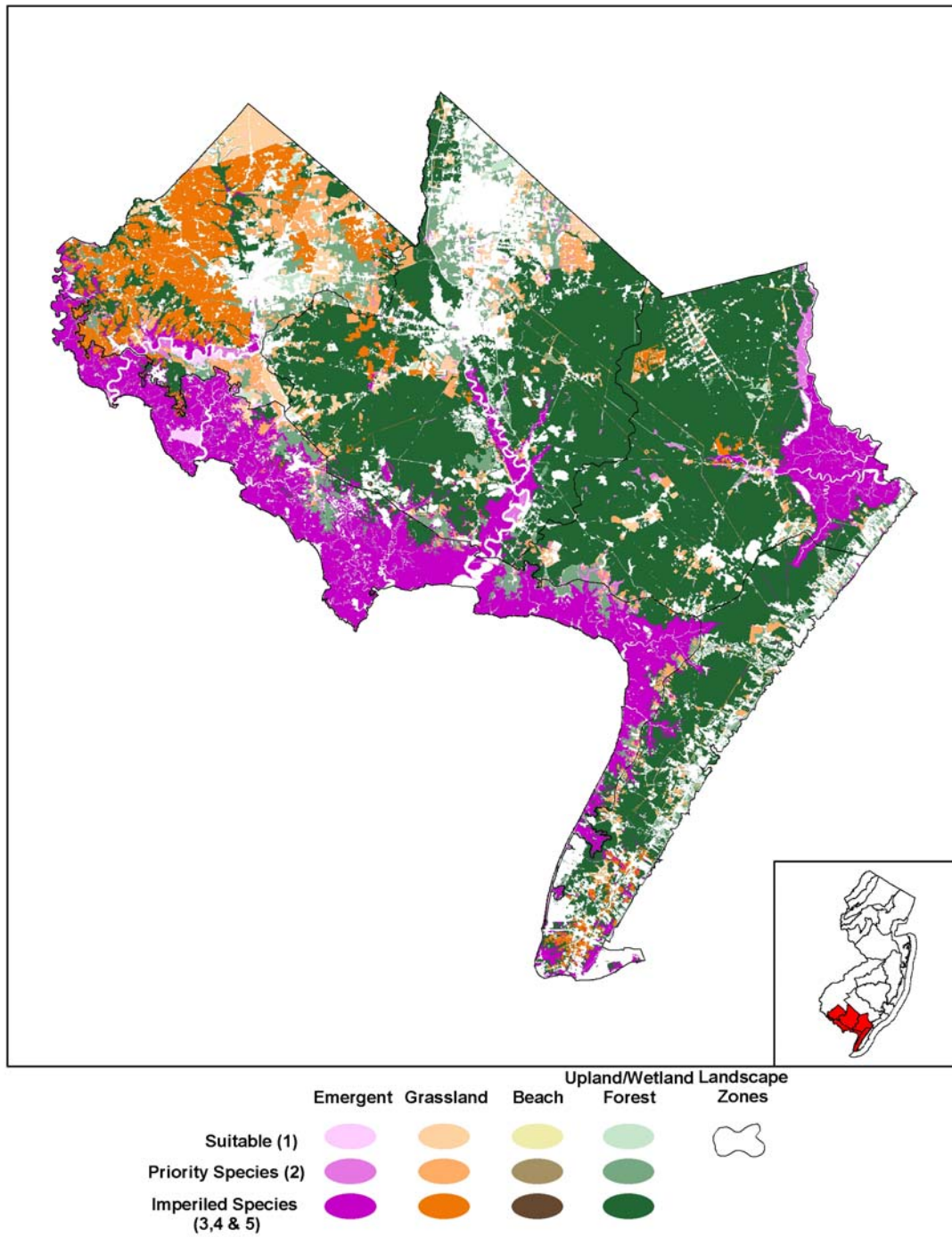
- (1) Cohansey River
- (2) Maurice River Watershed
- (3) Tuckahoe River Watershed.
- (4) Delaware Bay Shoreline
- (5) Cape May Peninsula

D. Wildlife of Greatest Conservation Need

The Delaware Bay Landscape is essential for the viability of national and international bird migrations as well as rare New Jersey wildlife. This region includes the Delaware Bay coast and marshes, critical stopover habitat for Western Hemispheric migratory shorebirds, including red knots, which depend on this coastline and an abundant food supply. This region also includes the Cape May Peninsula, nationally recognized for its high-density migration of passerines, American woodcock, and raptors that are funneled along the Atlantic and Delaware Bay coasts. The Delaware Bay region supports the largest portion of the state's bald eagle population, and has been essential to the recovery of the eagle in the state. The Delaware Bay region is a critical migration and wintering area for American black ducks in the Atlantic Flyway. The marshes of the large rivers of this region support one of the largest fall concentrations of sora in the Atlantic Flyway. The region is crucial to the state's population of eastern tiger salamander, Cope's gray treefrog, northern harrier and black rail. In addition, the region holds some of the state's largest contiguous forest blocks, which support species that depend on unbroken forest habitats – some of the most rare and sensitive species in the state.

Delaware Bay beaches, wetlands, forests, and grasslands support an abundance of rare and migratory wildlife. Included are one federal threatened species (bald eagle), with other federally-listed aquatic species (sea turtles and shortnose sturgeon) marginally supported in this region. There are 12 state endangered, 14 state threatened, and 128 special concern and regional priority wildlife species. The black skimmer, Henslow's sparrow, least tern, northern harrier,

1
2 **Figure 11.** Critical landscape habitats within the Delaware Bay Landscape and associated
3 conservation zones as identified through the Landscape Map (v2).



peregrine falcon, red-shouldered hawk, short-eared owl, sedge wren, vesper sparrow, corn snake, Cope's gray treefrog, eastern tiger salamander, and bronze copper are the state endangered wildlife in the Delaware Bay Landscape. State threatened wildlife include the barred owl, black rail, black-crowned night-heron, bobolink, Cooper's hawk, grasshopper sparrow, long-eared owl, osprey, red knot, red-headed woodpecker, savannah sparrow, northern pine snake, Pine Barrens treefrog, and frosted elfin. Special concern wildlife include cavity-nesters, coastal marsh birds, colonial waterbirds, forest passerines, grassland birds, and scrub-shrub/open field birds; northern diamondback terrapins, carpenter frogs, and other reptiles and amphibians. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, occur in the Delaware Bay.

The following tables list the wildlife of greatest conservation need, the suites of wildlife, and the conservation opportunity areas to conserve them in the Delaware Bay Landscape. The wildlife are prioritized by federal endangered and threatened, state endangered, state threatened, and special concern and regional priority status.

Prioritized List of the Wildlife of Greatest Conservation Need and their Location in the Delaware Bay Landscape

Table DB1. Federal Endangered and Threatened Species*

Common Name	Federal Status & Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Mammals						
Indiana bat	E		R**	R**		
Birds						
Bald eagle	T	I	I	I	I	I
Reptiles						
Green sea turtle	T				I	
Leatherback sea turtle	E				I	
Loggerhead sea turtle	T				I	
Bog turtle	T	R				
Hawksbill sea turtle	E				I	
Kemp's ridley sea turtle	E				I	
Fish						
Shortnose sturgeon	E & RP				R	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

T: Federally threatened species.

E: Federally endangered species.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table DB2. State Endangered Species

Common Name	Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Mammals						
Bobcat			R	R		
Birds						
American bittern	RP	R	R	R		
Black skimmer	RP				R	
Henslow's sparrow	RP	R				
Least tern	RP		M		I	
Loggerhead shrike	RP	R				R

State Endangered Species (continued)

Common Name	Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Birds (continued)						
Northern harrier		I	I	I	I	I
Peregrine falcon			M	M	M	M
Pied-billed grebe	RP					I
Red-shouldered hawk		I	I	I		I
Sedge wren	RP				I	
Short-eared owl	RP				I	
Vesper sparrow		I	I			
Reptiles						
Corn snake			I			
Timber rattlesnake			R	R		
Amphibians						
Cope's gray treefrog		M	I	I		I
Eastern tiger salamander			I	I		I
Insects						
Bronze copper		I	I			

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table DB3. State Threatened Species

Common Name	Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Birds						
Barred owl		I	I	I		I
Black rail	RP		I		I	
Black-crowned night-heron	RP		I	I	I	I
Bobolink	RP	I	M			
Cooper's hawk	RP	I	I	I		I
Grasshopper sparrow	RP	I	M			
Long-eared owl			R	I		
Osprey		I	I	I	I	I
Red knot	RP		I	I	I	I
Red-headed woodpecker	RP	I	I	I		I
Savannah sparrow		I	M			
Yellow-crowned night heron	RP			R	R	R
Reptiles						
Northern pine snake			I	I		I
Amphibians						
Pine Barrens treefrog			I	I		I
Insects						
Frosted elfin			I	I		I

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table DB4. Nongame Species of Conservation Concern

Common Name	Conservation Status	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Mammals						
Eastern red bat	RP	R**	R**	R**		R**
Eastern small-footed myotis	S1, G3	R**	R**	R**		R**
Hoary bat	RP	R**	R**	R**		R**
Marsh rice rat	S3, G5				R	
Silver-haired bat	RP	R**	R**	R**		R**
Southern bog lemming	S2, G5		R	R		

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Birds						
Acadian flycatcher	RP	M	M	M		M
American golden-plover	RP					
American kestrel	SC/RP	I	I	I		I
American oystercatcher	SC/RP		M	M	M	M
Baltimore oriole	RP	I		I		I
Black tern	SC/RP				M	
Black-and-white warbler	RP	I	I	I		I
Black-billed cuckoo	RP	I	I	I		I
Black-throated green warbler	SC		I			
Blackburnian warbler	RP		M	M		M
Blue-winged warbler	RP	I	I	I		I
Broad-winged hawk	SC/RP	M	M	M		M
Brown thrasher	RP	I	I	I		I
Canada warbler	SC/RP		M	M		
Cattle egret	RP			M		M
Chimney swift	RP	I	I	I		I
Chuck-will's-widow	RP	I	I	I		I
Common barn owl	SC	I	I	I	I	I
Common nighthawk	SC		I	I		I
Common tern	SC/RP			I	I	I
Dickcissel	RP	I				
Eastern kingbird	RP	I	I	I		
Eastern meadowlark	SC/RP	I	M	M		M
Eastern screech-owl	RP	M	M	M		M
Eastern towhee	RP	I	I	I		I
Eastern wood-pewee	RP	I	I	I		I
Field sparrow	RP	I	M	M		M
Forster's tern	RP			M	M	M
Glossy ibis	RP			M	I	M
Gray catbird	RP	M	M	M		M
Great blue heron	SC/RP	M	M	M	M	M
Great crested flycatcher	RP	I	I	I		I
Great egret	RP	M	M	M	M	M
Greater shearwater	RP					
Green heron	RP		M	M	M	M
Horned grebe	RP					
Hooded warbler	RP		M	M		M
Horned lark	SC	I				
Indigo bunting	RP	I	I	I		I
Kentucky warbler	SC/RP	I	I	I		I
King rail	SC/RP		M	M	M	M
Least bittern	SC/RP	M	M	M	M	M
Little blue heron	SC/RP		M		M	M
Louisiana waterthrush	RP	M	M	M		M
Mallard	RP	M	M	M	M	M
Marsh wren	RP	M	M	M	M	M
Northern flicker	RP	I	I	I		I
Northern gannet	RP					
Northern parula	SC		M	M		M
Pine warbler	RP	M	M	M		M
Prairie warbler	RP	I	I	I		I
Prothonotary warbler	RP	I	I	I		I
Razorbill	RP					
Red-throated loon	RP					
Rose-breasted grosbeak	RP			I		
Ruddy turnstone	RP		I		I	
Saltmarsh sharp-tailed sparrow	RP		I	I	I	I
Sanderling	SC/RP				I	
Scarlet tanager	RP	I	I	I		I
Seaside sparrow	RP	M	M	M	M	M

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Birds (continued)						
Semipalmated sandpiper	RP		I		I	
Sharp-shinned hawk	SC/RP		M	M	M	M
Snowy egret	SC/RP		M	M	I	M
Spotted sandpiper	SC		M	M		
Tricolored heron	SC/RP				I	M
Veery	SC		I	I		
Whip-poor-will	RP	I	I	I		I
Willet	RP		M	M	M	M
Willow flycatcher	RP	I	I	I		I
Wood thrush	RP	I	I	I		I
Worm-eating warbler	RP		M	M		M
Yellow-billed cuckoo	RP	I	I	I		I
Yellow-breasted chat	SC/RP	I	I	I		I
Yellow-throated vireo	RP	I	I	I		I
Yellow-throated warbler	RP	M	M	M		M
Reptiles						
Eastern box turtle	SC	M	M	M		M
Eastern kingsnake	SC	M	M	M		M
N. diamondback terrapin	SC		I	I	I	
Spotted turtle	SC	M	M	M		M
Amphibians						
Carpenter frog	SC	M	M	M		M
Fowler's toad	SC	M	M	M		M
Marbled salamander	SC	M	M	M		M
Insects						
Dotted skipper, <i>Hesperia attalus</i>	SC		M			
Hessel's hairstreak, <i>Callophrys hesseli</i>	SC	M	M			
A geometrid moth, <i>Eusarca fundaria</i>	S2S3, G4				X	
A geometrid moth, <i>Idaea violacearia</i>	S1S3, G4		X			
A geometrid moth, <i>Metarranthis sp 1</i>	S2, G3		X	X		
A noctuid moth, <i>Apamea inebriata</i>	S2S4, G4		X			
A noctuid moth, <i>Cucullia alfarata</i>	S2?, G4				X	X
A noctuid moth, <i>Macrochilo santerivalis</i>	S1S3, G3G4		X			
A noctuid moth, <i>Macrochilo sp 1</i>	S3, G3		X			
A noctuid moth, <i>Meropleon cosmion</i>	S1S2, G4			X		
A noctuid moth, <i>Meropleon titan</i>	S1, G2G4	X			X	
Chain fern borer moth, <i>Papaipema stenocelis</i>	S3, G4		X	X		
Half yellow moth, <i>Tarachidia semiflava</i>	S2S4, G4		X			
Lemmer's pinion moth, <i>Lithophane lemmeri</i>	S2, G3G4		X			
Maritime sunflower borer, <i>Papaipema maritime</i>	S1, G4					X
Pine Barrens bluet, <i>Enallagma recurvatum</i>	S3, G3		X	X		
Pink streak, <i>Faronta rubripennis</i>	S3, G3G4	X			X	
Precious underwing, <i>Catocala pretiosa pretiosa</i>	S2S3, G4		X	X	X	X

Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Insects (continued)						
Rare skipper, <i>Problema bulenta</i>	S2, G2G3	X	X	X	X	X
Regal moth, <i>Citheronia regalis</i>	S3, G5			X		
Rippled wave, <i>Idaea obfusaria</i>	S2S4, G4G5		X	X		
Scarlet bluet, <i>Enallagma pictum</i>	S3, G3		X	X		
The consort, or consors underwing, <i>Catocala consors sorsconi</i>	S1S3, G4		X			
Fish						
Atlantic sturgeon	SC*/RP			X	X	X

* Federal species of special concern

**Potential presence

SC: Species of special concern as identified within the state.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

S & G: Conservation Ranks defined in Appendix I.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

Table DB5. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Species of Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Birds						
American black duck	RP	M	M	M	M	M
American woodcock	RP	I	I	I	I	I
Black scoter	RP				R	R
Bufflehead	RP	M		M	M	M
Canada Goose (Atlantic population)	RP	M	M	M	M	M
Canvasback	RP			I	I	
Clapper rail	RP	M	M	M	M	M
Greater scaup	RP			I	I	
Lesser scaup	RP			I	I	
Long-tailed duck	RP				R	R
Northern bobwhite quail	RP	R	R	R	R	R
Northern pintail	RP	I	I	I	I	I
Surf scoter	RP				R	R
Virginia rail	RP	R	R	R	R	R
White-winged scoter	RP				R	R
Wood duck	RP	M	M	M	M	M

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table DB6. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Species of Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Fish						
Margined madtom (<i>Noturus insignis</i>)	-		X			

X: Species present. Management strategy not yet determined.

Table DB7. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Species of Regional Priority	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Mammals						
River otter	-	M	M	M	M	M
Birds						
Ruffed grouse	-	R				
Sora rail	-	R	R	R	R	R

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table DB8. Suites of Wildlife and their Location in the Delaware Bay Landscape

Common Name	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Mammals					
Forest Dwelling Bats	X	X	X		X
Birds					
Beach-nesting Birds			X	X	
Interior-forest Cavity-nesters		X	X		X
Savannah and Forest-edge Habitat Cavity Nesters	X	X	X		X
Coastal High Marsh Birds	X	X	X	X	
Coastal Low Marsh Birds	X	X	X	X	
Colonial Waterbirds	X	X	X	X	X
Forest Passerines	X	X	X		X
Forest Raptors	X	X	X		X
Freshwater Wetland Birds	X	X	X		X
Grassland Birds	X	X			
Migratory Shorebirds			X		X
Migratory Songbirds and Raptors	X	X	X	X	X
Scrub-shrub/Open Field (3-7 yrs) Birds	X	X	X		X
Early Succession (0 -3 years) Open Field Birds	X				
Waterfowl	X	X	X	X	X
Reptiles					
Forest Dwelling Reptiles		X	X		X
Reptile Inhabitants of Wetland, Marsh and Bog	X	X	X	X	X
Reptiles Associated with water (lakes, ponds, streams)	X	X	X		X
Reptiles of Special Concern	X	X	X	X	X
Amphibians					
Amphibians of Special Concern	X	X	X		X

Suites of Wildlife and their Location in the Delaware Bay Landscape (continued)

Common Name	Cohansey River	Maurice River Watershed	Tuckahoe River Watershed	Delaware Bay Shoreline	Cape May Peninsula
Amphibians (continued)					
Vernal Pool and Vernal Sinkhole Breeders	X	X	X		X
Insects					
Lepidoptera of Federal or State Legal Status		X	X		X
Lepidoptera of Special Concern	X	X			X
Odonata		X	X		X

X: Species occurs within the identified habitat.

E. Threats

The Delaware Bay region ranges from agricultural land around the Cohansey to forests in the Maurice, Tuckahoe and peninsula areas and to the saltmarshes of the bayshore. The overall threat to habitat and wildlife is habitat loss due to development, particularly on the Cape May Peninsula. Fragmentation of forests is a major threat to the forested areas of the Maurice and Tuckahoe, because of the forest dependent species that depend on them for survival. The publicly owned land, particularly in the Maurice and Tuckahoe areas, will be absolutely essential as core habitat for rare wildlife populations in the future; expanding those lands by both acquisition and private lands management will help to ensure viability of rare species in the state. Invasive plants and animals displace native species. Recreation on the waterways of the rivers and bays, in the resort areas of the peninsula, and illegal off-road vehicle use in forests continues to grow and should be addressed in management and education. Delaware Bay, as a major shipping and transportation port will continue to hold the threat of oil and chemical contamination to riparian habitats.

F. Conservation Zones, Assessments, and Strategies within the Delaware Bay Landscape

1. Cohansey River

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring success*

a. Habitats

This Conservation Zone in western Cumberland County encompasses the Cohansey River and its associated marshes and grasslands (Figure 12). The rich farmlands along the river system are an extension of predominant habitats of Salem County. Not all habitats classified as grassland are suitable for grassland birds, as agricultural uses often create unsuitable conditions for early-succession wildlife. The region has some stands of wild rice marshes, tidal marshes, freshwater wetlands, and upland pine-oak forest.

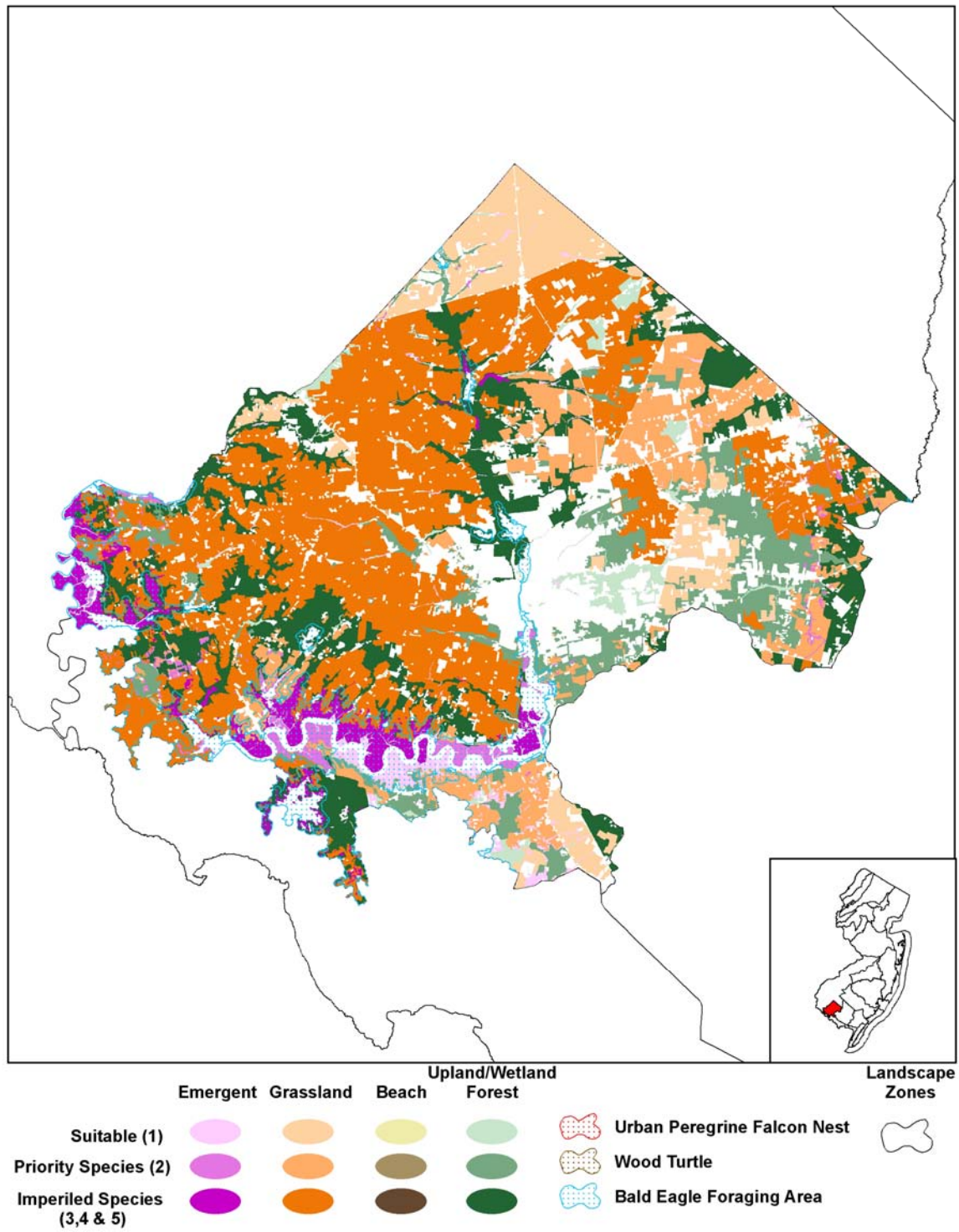
This zone has the least amount of public land in the Delaware Bay region, with approximately less than 405 hectares (1.5 sq. mi.). However, there are significant opportunities for preserving farmland and maintaining vast areas of tidal marsh.

b. Wildlife of Greatest Conservation Need

The Cohansey River region supports one federal threatened, five state endangered, seven state threatened, and 48 special concern and regional priority wildlife species. The bald eagle is the federal threatened species. Northern harriers, red-shouldered hawks, vesper sparrows, Cope's gray treefrogs, and bronze coppers are among the state endangered wildlife. State threatened species include barred owls, bobolinks, Cooper's hawks, grasshopper sparrows, ospreys, red-headed woodpeckers, and savannah sparrows. Special concern wildlife includes grassland birds, scrub-shrub birds, forest passerines, reptiles and amphibians. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, are suspected to occur in the Cohansey River zone.

The Cohansey River area is notable for supporting one of the densest bald eagle populations in the state for both nesting and wintering eagles. As part of the Atlantic Flyway, the habitats along the river are also important to the migration of songbirds, water birds, and raptors. Hardwood swamps and the mosaic of forest and agricultural land are habitat for bald eagles, migrating raptors and passerines, Cooper's and broad-winged hawks, and eastern box turtle. The grasslands are particularly valuable habitat for nesting grassland birds, supporting six listed grassland bird species. Marshes, tidal wetlands, and other wetlands are habitat for rails, northern harriers, bronze coppers, and rare damselflies and dragonflies. Tables DB9 - DB14 identify the species of greatest conservation need within this zone.

1 **Figure 12.** Critical landscape habitats within the Cohansey River conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of Cohansey River

Table DB9. Federal Endangered Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Bald eagle		X	X	X
Reptiles				
Bog turtle		X		X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

X: Species occurs within the identified habitat.

Table DB10. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American bittern		X		
Loggerhead shrike			R	
Northern harrier		X	X	
Red-shouldered hawk				X
Vesper sparrow			X	
Amphibians				
Cope's gray treefrog				X
Insects				
Bronze copper		X		

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

Table DB11. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	

X: Species occurs within the identified habitat.

Table DB12. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				X*
Hoary bat				X*
Silver-haired bat				X*
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Chimney swift			X	X
Chuck-will's-widow				X
Common barn owl			X	
Dickcissel			X	
Eastern kingbird			X	X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Great blue heron		X		
Great-crested flycatcher				X
Great egret		X		
Horned lark			R	
Indigo bunting			X	X
Kentucky warbler				X
Least bittern		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Pine warbler				X
Prothonotary warbler				X
Scarlet tanager				X
Seaside sparrow				
Whip-poor-will				X
Wood thrush				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X
Eastern king snake				X
Spotted turtle		X		
Amphibians				
Carpenter frog		X		X
Fowler's toad		X		
Marbled salamander		X		X
Insects				
Hessel's hairstreak		X		X
A noctuid moth, <i>Meropleon titan</i>		X		
Pink streak, <i>Faronta rubripennis</i>				X
Rare skipper, <i>Problema bulenta</i>				X

*Potential presence.

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

6 Table DB13. Game Species of Regional Priority

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock				X
Bufflehead	X	X		
Canada Goose (Atlantic population)	X	X		
Clapper rail		X		
Northern bobwhite quail			X	X
Northern pintail	X	X		
Virginia rail		X		
Wood duck				

X: Species occurs within the identified habitat.

Table DB14. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Cohansey River

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Cohansey zone of the Delaware Bay landscape region remains a relatively rural area dominated by agriculture. However, critical wildlife habitat is threatened in a number of ways: fragmentation and loss of grasslands due to development expansion from Bridgeton; intensive agriculture methods that don't allow grassland birds to nest successfully; and conversion of grasslands and annual agriculture fields to nursery stock sites. The Cohansey River and its associated wetlands and forest patches are critical to the regional and statewide bald eagle nesting and wintering population, and are threatened by development associated with a growing human population, as well as potential heavy uses of the river for recreation and transportation. Furthermore, this zone contains very little publicly-owned land, so long-term protection will be a challenge. Landowner incentives and easements will be important conservation tools here. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, enhance, and restore critical habitats as identified by the Landscape Project, focusing on habitat for bald eagle, osprey and northern harrier populations, and grassland bird and scrub-shrub bird communities. Identify areas where 2,000-3,000 ha (7.7 – 11.5 square miles) of grassland and early-successional habitats can be managed for viable grassland bird populations.
- Inventory and monitor all endangered, threatened and special concern wildlife in this zone.
- Prevent, stabilize, and reverse declines of grassland bird and scrub-shrub bird species.
- Maintain and enhance populations of nesting and wintering bald eagles, ospreys and northern harriers.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Identify and survey habitats for presence of rare invertebrate wildlife, including damselflies and dragonflies.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.

- Protect water quality and the availability of wetland habitats.
- Identify and protect summer roosting habitat for Indiana bats and other forest-dwelling bat species.
- Promote public education and awareness and wildlife conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical grassland habitats and assess their condition for nesting birds, and maintain information in the Landscape Project and Biotics database. Identify protection strategies (e.g., landowner incentives, farmland preservation, and acquisition) to maintain large core areas of grassland in perpetuity. Identify proximate habitats that can be managed to enhance the total size of suitable grassland habitat, with the goal of managing grassland/early succession areas totaling 2,000-3,000 ha (7.7–11.5 square miles). (<i>Protect habitat – Landscape Project</i>)
1°	Act to maintain, enhance, and restore habitat, as appropriate, to maintain and restore grassland bird populations. Acquire habitat through direct purchase or easements and enlist private lands in preservation and management programs that offer long-term stability of a matrix of grassland schemes. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Continue to identify critical habitats and assess their condition for bald eagle nesting and wintering populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing eagle habitat and minimize threats in perpetuity. (<i>Conserve wildlife – rare wildlife</i>)
1°	Act to maintain, enhance, and restore habitat, as appropriate, for bald eagles. Acquire forest and riverine habitats through direct purchase or easements; enlist private lands in preservation programs that will maintain forests free of human disturbance during key periods. (<i>Conserve wildlife – rare wildlife Enhance habitat – private lands</i>)
1°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, grassland bird and scrub-shrub bird populations.
1°	Identify and implement best management practices to guide private and public landowners, to enhance habitats for grassland bird and scrub-shrub bird communities, bald eagles, ospreys, migratory passerines and raptors. (<i>Other practices – land management</i>)
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements become available. (<i>Protect habitat – Landscape Project</i>)

1

Priority	Conservation Actions (continued)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, land acquisition priorities, and development of management strategies for permanently protected lands. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – migratory birds</i>)
1°	Identify and map significant natural vegetative communities, particularly on public lands and lands that serve as wildlife corridors. (<i>Protect habitat – Landscape Project; Corridors – migratory birds</i>)
Inventory and monitor endangered, threatened and special concern wildlife	
1°	Survey suitable habitats to determine distribution and trends of grassland birds on a regular basis. Survey and monitor grassland bird nesting every four years, with more frequent surveys in actively managed grasslands. Survey and monitor bald eagle nesting and production annually. Survey and monitor ospreys every three years, woodland raptors every four years. (<i>Conserve wildlife – rare wildlife, Monitor wildlife – long-term monitoring</i>)
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks), northern saw-whet owls, and eastern screech-owls. (<i>Conserve wildlife – rare wildlife</i>)
2°	Develop management guidelines for private landowners with significant bald eagle, grassland and scrub-shrub bird populations. (<i>Conserve wildlife – rare wildlife</i>)
Prevent and reverse declines of grassland birds	
1°	Act to restore, maintain and enhance habitat, as appropriate, for grassland birds. Acquire grassland habitat through direct purchase or easements; enlist private lands in preservation and management programs that offer long-term stability of a matrix of grassland schemes. Target 2,000 hectare (7.7 sq. mi.) regions. (<i>Conserve wildlife – rare wildlife; Enhance habitat – private lands; Agriculture – land management</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened grassland and scrub-shrub species within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, particularly for grassland species and bald eagle. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available. (<i>Protect habitat – Landscape Project</i>)
1°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, grassland bird and scrub-shrub bird populations (<i>Enhance habitat – private lands; Agriculture – land management</i>).

1

Priority	Conservation Actions (continued)
1°	Implement policies to reduce mortality of grassland and ground-nesting birds due to feral cats. (<i>Conserve wildlife–cats, subsidized predators</i>)
2°	Research the intensity and characteristics of threats to wildlife and their habitats, including causes and effects of habitat loss and degradation, disturbance, contaminants, predation, food availability, and invasive plants. (<i>Protect habitat – sprawl, recreational vehicles, humans; Conserve wildlife – contaminants, invasives</i>)
2°	Continue to investigate habitat requirements for grassland birds. Develop guidance on prescribed burning and other management techniques for grassland species.
2°	Develop management guidelines for private landowners with significant bald eagle, grassland and scrub-shrub bird populations. (<i>Enhance habitat – private lands</i>)
Maintain and enhance bald eagles, ospreys and northern harriers	
1°	Continue to identify critical habitats and assess their condition for bald eagle nesting and wintering populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing eagle habitat and minimize threats in perpetuity. (<i>Conserve wildlife – rare wildlife</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for bald eagles. Acquire forest and riverine habitats through direct purchase or easements; enlist private lands in preservation programs that will maintain forests free of human disturbance during key periods. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Maintain and manage forest patches adjacent to marshes for bald eagle and raptor suitability. Maintain and enhance floodplain forests for forest passerines and raptors. Set and implement guidelines for human disturbance on critical lands and allow forests and forest patches to mature to old growth to maximize suitability. (<i>Conserve wildlife – rare wildlife; Silviculture – land management</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, particularly for grassland species and bald eagles. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
Protect rare invertebrate wildlife	
1°	Develop and implement proactive species recovery plans for invertebrate species identified as E, T, and SC within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, consistent with priorities for grassland species and bald eagle. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
Monitor, maintain and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Determine carrying capacity of area marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for migratory and wintering waterfowl populations of conservation concern. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl of conservation concern. (<i>Conserve wildlife – game species</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Develop area-specific deer density or percent-reduction targets. (<i>Conserve wildlife - deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer. (<i>Conserve wildlife - deer</i>)
1°	Survey and monitor for the spread of invasive insect species that jeopardize forest health. Species of primary concern include the southern pine beetle, gypsy moth, and oak lace bug. Collaborate on appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
1°	Act to control the spread of phragmites in the tidal Cohansey River. (<i>Conserve wildlife – invasives</i>)
1°	Identify areas through surveys and public participation where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Reduce impacts of mute swan herbivory to native vegetation in impoundments and marshes of the Cohansey River. (<i>Conserve wildlife – invasives</i>)
1°	Monitor impacts of snow goose herbivory to Cohansey River salt marshes.
1°	Work with public and private landowners to employ physical, chemical or biological control measures to eradicate invasive plants in areas identified as critical habitat for endangered, threatened or priority wildlife, and threatened by invasive non-indigenous plants. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
Protect water quality and maintain adequate buffers	
1°	Maintain larger buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat – fish</i>)
1°	Develop a fish Index of Biotic Integrity (IBI) to better assess the area's streams. (<i>Protect habitat – fish</i>)
Priority	Conservation Actions (continued)

1°	Seek Category One antidegradation classifications in water bodies where listed or special concern species occur, or where there are high levels of biological integrity based on fish assemblage. Seek other appropriate classifications for stream segments based on IBI results. (<i>Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife - fish</i>)
2°	Identify and research water quality parameters for bald eagle, osprey, spotted turtle, and special concern amphibian populations.
Identify and protect habitat for Indiana bats and other forest dwelling bat species	
2°	Determine summer range and habitat use for Indiana bats and other forest dwelling bat species. Use data to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., providing landowner incentives for enhancing and protecting habitat, promoting public education regarding importance of bat conservation). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
2°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Promote public education and awareness and wildlife conservation	
2°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
2°	Encourage native plant use in landscaping through public awareness and landscaping companies, as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Encourage farmers to preserve farmland through conservation easements and Transfer of Development Rights (TDRs) through partnerships with NJ DEP's Green Acres, The Nature Conservancy–NJ Chapter, NJ State Agriculture Development Committee (NJ SADC), NJ Farm Bureau, local land trusts, and local municipalities for the conservation of bog turtle, forest and grassland bird populations.
- Use landowner incentive programs (DFW's LIP; USDA's NRCS programs; and USFWS' Partners for Fish and Wildlife) to encourage private landowners to manage for endangered and threatened species found on their property through restoration, protection or management activities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups (NJ Audubon Society, The Nature Conservancy, NJ Conservation Foundation) and other environmental, member-based

- 1 organizations to recruit and train Citizen Scientists to locate, survey, and monitor
- 2 wildlife habitats and populations in a systematic manner to achieve short- and long-
- 3 term monitoring goals.
- 4 ○ Involve Citizen Scientists in management projects and protection projects, such as
- 5 protection and posting of bald eagle nesting areas and installing new osprey nest
- 6 structures.
- 7 ○ Recruit North American Butterfly Association volunteers to conduct surveys for
- 8 lepidoptera species.
- 9 ○ Promote backyard habitat management for migratory raptors and passerines.
- 10 • Collaborate with NJ Audubon Society to educate public on the effects of feral cats on
- 11 wildlife species of conservation concern.

12 Wildlife Professionals

- 14 • Collaborate with researchers in New York, Pennsylvania, Delaware, and West Virginia to
- 15 develop best management practices and conservation plans for grassland and scrub-
- 16 shrub/open field birds.
- 17 • Collaborate with researchers in Delaware, Maryland, Virginia, New York, and Pennsylvania
- 18 to develop best management practices and conservation plans for bald eagle nesting, foraging
- 19 and wintering areas.
- 20 • Consult with entomologists to design and conduct surveys for bronze coppers in wet
- 21 meadows, marshes, fens, and other appropriate habitats.

22 Conservation Organizations

- 24 • Partner with watershed and conservation organizations such as NJ Audubon Society (NJAS)
- 25 and The Nature Conservancy (TNC) to protect and enhance habitats for rare species.
- 26 ○ Protect and enhance grassland bird habitats.
- 27 ○ Protect bald eagle, osprey, and raptor nesting, foraging, and wintering areas.
- 28 ○ Install new osprey nest structures.
- 29 • Consult with conservation and watershed organizations to develop educational programs
- 30 such as classroom curricula and wildlife festivals.
- 31 • Encourage the use of the Landscape Project's critical habitat mapping to guide land
- 32 acquisition by conservation organizations through programs such as Green Acres, State
- 33 Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.

34 Local Government, Other State and Federal Agencies

- 36 • Partner with local, state, and federal government agencies, including municipal and county
- 37 planning boards, USDA's Natural Resources Conservation Service (NRCS), US Fish and
- 38 Wildlife Service (USFWS), and the Department of Community Affairs (DCA), Office of
- 39 Smart Growth to protect, enhance, and create habitats, and to protect NJ's native wildlife.
- 40 ○ NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife
- 41 (DFW) to maintain and protect bald eagle, osprey, and grassland bird nesting and
- 42 foraging sites.
- 43 ○ DFW, conservation organizations, and land trusts to identify key lands for acquisition
- 44 and conservation.
- 45 ○ DFW and DEP's Division of Parks and Forestry (DPF) to pursue identification and
- 46 mapping of significant natural vegetative communities, particularly on public lands

- 1 and lands that serve as wildlife corridors, and integrate these in the Landscape
- 2 Project.
- 3 ○ DFW to develop a plan to protect sensitive endangered/threatened species areas from
- 4 disturbance.
- 5 ○ DFW to share site information and expertise with state and federal law enforcement
- 6 to increase surveillance of bald eagle sites.
- 7 ○ DFW and conservation organizations to work with the DEP's Land Use Regulation
- 8 Program (LURP) to protect vernal pools and appropriately classify wetlands for
- 9 spotted turtle, special concern amphibian, and bronze copper populations.
- 10 ○ Expand efforts to create habitat and implement best management practices for
- 11 grassland birds, forest passerines and raptors, and scrub-shrub birds on state lands and
- 12 with natural resource managers, county and municipal utility authorities and planners.
- 13 ○ Work with Division of Watershed Management and other DEP agencies to establish
- 14 larger buffers for riparian and floodplain areas.
- 15 ○ DFW to work with state and county mosquito commissions to reduce the use of
- 16 deleterious insecticides and biological controls at known amphibian breeding sites.
- 17 ○ DFW to work with USFWS and other state, federal, and non-governmental partners
- 18 to implement North American Waterfowl Management Plan as appropriate.
- 19 ○ DFW to work with USFWS and other state and federal partners to implement the
- 20 American Woodcock Management Plan, seeking areas where such management
- 21 complements rare species management.
- 22 ○ DFW to work with federal and state agencies, including USFWS, USCG, National
- 23 Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and
- 24 NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with
- 25 emergency oil spill response.
- 26 ○ DFW and DPF to work with the USFWS to develop effective plans to eradicate
- 27 invasive non-indigenous plants on federal and state lands that are threatening critical
- 28 wildlife habitats.
- 29 ○ DFW to work with USDA through NRCS and the WHIP program to control purple
- 30 loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- 31 • DFW to determine groundwater recharge areas for vernal pools with the DEP's Division of
- 32 Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to
- 33 minimize impacts on water quality and conduct hydrological monitoring in these areas.
- 34 • DFW to work with DEP's Bureau of Water Monitoring and Standards to recommend
- 35 appropriate stream classifications.
- 36 • DFW to lead in the development of educational materials for private landowners about
- 37 wildlife of greatest conservation need and their habitats.
- 38 • DFW, conservation organizations, and park commissions to expand public outreach through
- 39 on-site programs and wildlife viewing opportunities.
- 40 • DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat
- 41 protection and land acquisition by federal, state, and local governments through programs
- 42 such as DEP's Green Acres Program, State Agricultural Development Committee Farmland
- 43 Preservation, local land trusts, and through mitigation.
- 44 • DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land
- 45 use planning and zoning decisions by planning agencies at the federal, state, and local level.
- 46

1 **g. Monitoring Success**

- 2 • Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of
- 3 habitat management and restoration efforts on a site by site basis.
- 4 • Annually monitor abundance, productivity, distribution, and trends of bald eagle, osprey
- 5 (biannually), and grassland bird and scrub-shrub bird populations. Compare vegetation
- 6 parameters and populations between managed/protected sites and non-managed sites to
- 7 provide feedback into management strategies.
- 8 • Monitor contaminant levels in Cohansey River and Stow Creek fish that may impact bald
- 9 eagle and osprey populations.
- 10 • Monitor species abundance of migratory raptors at key marsh-edge locations to determine
- 11 trends in migration counts.
- 12 • Monitor populations of breeding, migratory and wintering waterfowl of conservation
- 13 concern.
- 14 • Continue the long-term monitoring of reptile and amphibian populations through the Herp
- 15 Atlas Project, Calling Amphibian Monitoring Program, and volunteer coverboard surveys.
- 16
- 17

2. Maurice River Watershed

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring success*

a. Habitats

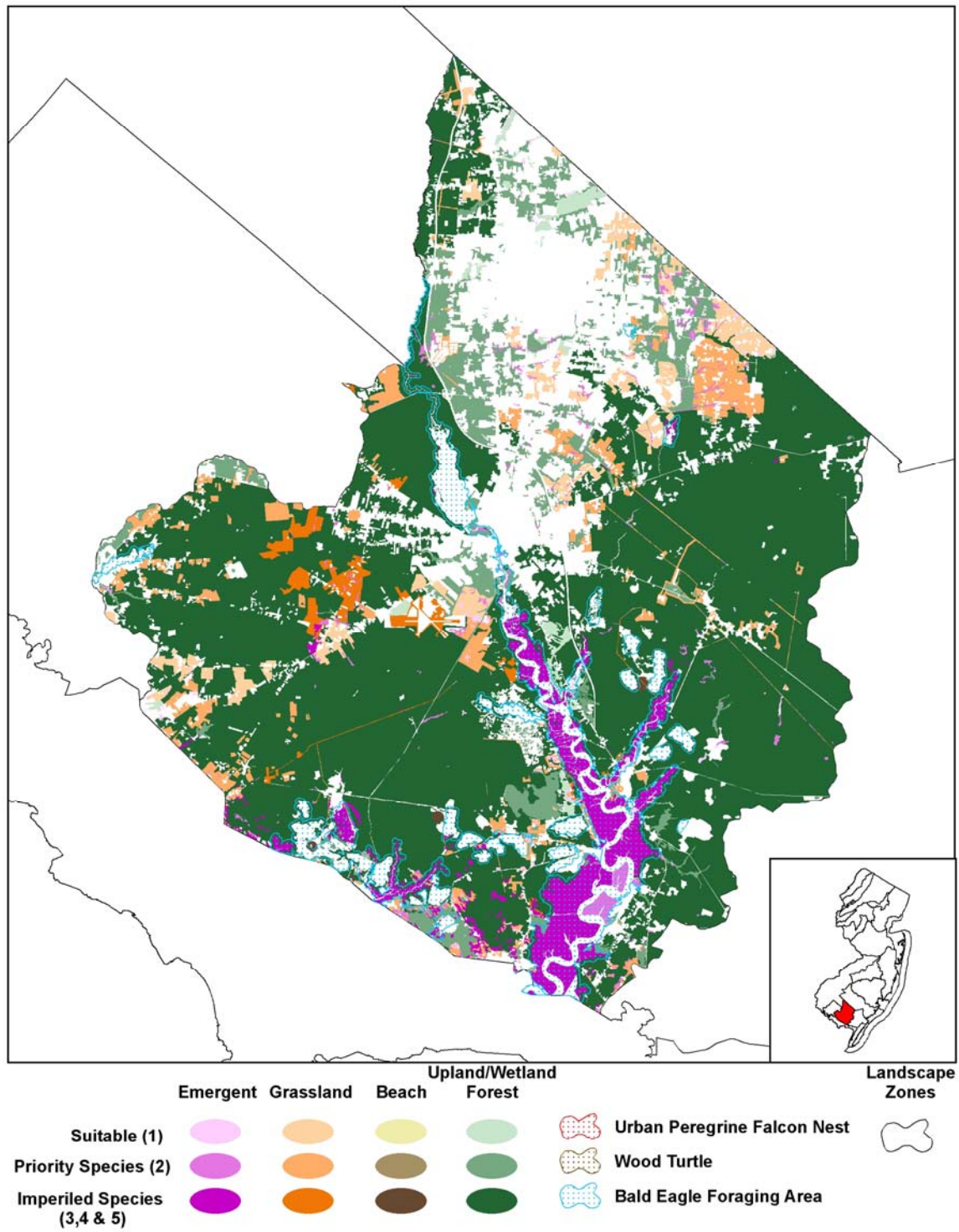
The nationally designated Wild and Scenic Maurice River is the western edge of the Pinelands National Reserve and is an important link between Pinelands and estuary habitats of Delaware Bay (Figure 13). Marshes of the Maurice River and its tributaries include the largest tidal, freshwater emergent marshes in New Jersey. Large tracts of undeveloped wetland forest and pine and oak upland forest characteristic of the Pinelands are found along the banks of the Maurice River. The Maurice River and its tributaries (the Manumuskin, Menantico, and Muskee creeks) hold habitats that are significant for many rare wildlife and plant populations.

This zone is most notable for large forest tracts, both upland and wetland, that are critical to the continuation of much of southern New Jersey's forest-interior wildlife populations. Fortunately for many rare species, large areas of state and conservation lands are found in this zone, including Union Lake WMA, Peaslee WMA, Buckshutem WMA, Clarks Pond WMA, Menantico Pond WMA, Millville WMA, Bear Swamp East Natural Area, and parts of Heislerville and Nantuxent WMAs. Manumuskin River Preserve and the Glades Wildlife Refuge are major holdings of conservation organizations.

b. Wildlife of Greatest Conservation Need

This zone is most notable for large forest tracts that support southern New Jersey's forest-interior bird populations, including barred owls and red-shouldered hawks, as well as northern pine snakes and forest-dwelling bats. The Maurice River, its tributaries, and the associated forests form the center of one of the densest nesting and wintering populations of bald eagles in the state. Indeed, Bear Swamp Natural Area hosts the oldest continuously-occupied eagle nest in the state, and the Maurice River has supported the state's most significant eagle wintering population since the 1970s. The Maurice River marshes host one of the largest fall populations of sora rails in the Atlantic Flyway and also serve as a key spring staging area for northern pintails. Wetlands associated with the river and its tributaries are important for rare amphibian populations such as the eastern tiger salamanders, Southern gray treefrogs, and Pine Barrens treefrogs. Rare butterfly, moth, dragonfly, and damselfly populations are found in microhabitats of the riverine system as well as in upland forests and rights-of-way, the benefactors of land dedicated to conservation. Tables DB15 – DB21 identify the species of greatest conservation need within this zone.

1 **Figure 13.** Critical landscape habitats within the Maurice River Watershed conservation zone,
 2 as identified through the Landscape Map (v2).



3
4

Wildlife Species and Associated Habitats of Maurice River Watershed

Table DB15. Federal Endangered Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle		X	X	X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

X: Species occurs within the identified habitat.

Table DB16. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				R
Birds				
American bittern		R		
Least tern		X		
Northern harrier		X	X	
Peregrine falcon		X		
Red-shouldered hawk				X
Vesper sparrow			X	
Reptiles				
Corn snake				X
Timber rattlesnake				X
Amphibians				
Cope's gray treefrog		X		X
Eastern tiger salamander				X
Insects				
Bronze copper		X		

R: Research and possible restoration.

X: Species occurs within the identified habitat.

Table DB17. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black rail		X		
Black-crowned night heron		X		
Bobolink			X	X
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				R**
Osprey		X		
Red knot		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Northern pine snake				X
Amphibians				
Pine Barrens treefrog		X		X
Insects				
Frosted elfin		X		X

**Suspected presence.

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

1 Table DB18. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				X*
Hoary bat				X*
Silver-haired bat				X*
Southern bog lemming			X	X
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blackburnian warbler				X
Black-throated green warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Canada warbler				X
Chimney swift			X	
Chuck-will's-widow				X
Common barn owl			X	
Eastern kingbird			X	X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-peewee				X
Field sparrow			X	
Gray catbird			X	X
Great blue heron		X		
Great crested flycatcher				X
Great egret		X		
Green heron		X		
Hooded warbler				X
Horned lark			X	
Kentucky warbler				X
King rail		X		
Least bittern		X		
Least tern		X		
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Semipalmated sandpiper		X		
Sharp-shinned hawk				X
Snowy egret		X		
Spotted sandpiper		X		
Veery				X
Whip-poor-will				X
Willet		X		
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X
Eastern king snake				X
Northern diamondback terrapin		X		
Spotted turtle		X		X
Amphibians				
Carpenter frog		X		X
Fowlers toad		X		X
Marbled salamander		X		X
Insects				
Dotted skipper		X	X	
Hessel's hairstreak				X
<i>A geometrid moth, Idaea violacearia</i>				X
<i>A noctuid moth, Apamea inebriata</i>			X	
<i>A noctuid moth, Macrochilo santerivalis</i>			X	
<i>A noctuid moth, Macrochilo sp 1</i>			X	
Half yellow moth, <i>Tarachidia semiflava</i>			X	
Pine Barrens bluet, <i>Enallagma recurvatum</i>		X		
Precious underwing, <i>Catocala pretiosa pretiosa</i>				X
Rare skipper, <i>Problema bulenta</i>				X
Rippled wave, <i>Idaea obfusaria</i>			X	
Scarlet bluet, <i>Enallagma pictum</i>		X	X	
The consort, or consors underwing, <i>Catocala consors sorsconi</i>				X

*Potential presence.

X: Species occurs within the identified habitat.

Table DB19. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock				X
Canada Goose (Atlantic population)	X	X		
Clapper rail		X		
Northern bobwhite			X	X
Northern pintail	X	X		
Virginia rail		X		
Sora		X		
Wood duck		X		

X: Species occurs within the identified habitat.

Table DB20. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Margined madtom (<i>Noturus insignis</i>)	X

X: Species occurs within the identified habitat.

Table DB21. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Maurice River Watershed

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Maurice River area is notable for large contiguous forest tracts that support populations of endangered and threatened forest wildlife, and much of that land is in conservation ownership. Threats, however, exist in the form of forest fragmentation due to development, primarily by the residential and industrial expansion of Millville and Vineland. Those two municipalities have the least amount of wildlife habitat remaining, while the townships of Downe, Lawrence, Commercial and Maurice River still contain larger forested areas. Forest interior wildlife species are particularly sensitive to fragmentation that opens the forest canopy and improves conditions for predators and competing edge species. Thus widening roads, creating power lines and converting forests to nursery operations are all threats. Sand and gravel operations have created large gaps in habitats, and most continue to impinge further on upland and swamp forests. The river ecosystem may be threatened by invasive species such as phragmites, and contaminants from nearby industry and oil spills. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect and enhance critical habitats as identified by the Landscape Project for bald eagles and interior-forest passerines and raptors (especially red-shouldered hawks and barred owls).
- Prevent, stabilize, and reverse declines of interior-forest raptors and passerines (primarily), and stabilize populations of northern pine snakes, corn snakes, freshwater wetland birds, frosted elfins, special concern reptiles and amphibians, rare dragonflies and damselflies, butterflies and moths, and listed/rare fish.

- Protect and enhance wetland and open water habitats for ospreys, Cope's (Southern) gray treefrogs, eastern tiger salamanders, Pine Barrens treefrogs, foraging colonial waterbirds and waterfowl, and rare fish.
- Protect and enhance patch habitats for bronze copper and frosted elfin populations, and scrub-shrub bird communities where possible.
- Maintain and enhance populations of nesting and wintering bald eagles, ospreys and northern harriers associated with the Maurice River and its tributaries.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Inventory and monitor endangered, threatened and special concern wildlife in the Maurice River, its tributaries, and Bear Swamp forests, particularly forest-interior and forest-dependent wildlife.
- Identify and survey habitats for presence of rare invertebrate wildlife, including damselflies and dragonflies.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife
- Prevent illegal collection of rare reptiles and amphibians.
- Stabilize and reverse declines of rare fish populations.
- Identify and protect summer roosting habitat for Indiana bats and other forest-dwelling bat species.
- Research and restore timber rattlesnake and bobcat populations. The bobcat is suspected to exist in this zone but targeted research is needed.
- Promote public education and awareness and wildlife conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitats identified by the Landscape Project	
1°	Identify critical core forests and assess their condition for forest-nesting birds and bald eagles, and maintain information in the Landscape Project and Biotics database. Identify protection strategies (e.g., landowner incentives and acquisition) to maintain large core areas in perpetuity. Identify adjacent habitats that can be managed to enhance the total size of forest habitat. (<i>Protect habitat – Landscape Project</i>)
1°	Manage rights-of-way for frosted elfins and other scrub-shrub species with small area requirements. Target land acquisition to add important forest tracts to state ownership. (<i>Protect habitat –Landscape Project</i>)
1°	Maintain, enhance, and restore habitat, as appropriate. Manage forests for larger, more mature woodlands with large trees for cavity-nesters and a canopy closure of >80%. Maintain and enhance floodplain forests for forest passerines. Manage forest habitats for woodland raptor suitability. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. (<i>Protect habitat – Landscape Project; Silviculture – land management</i>)

1

Priority	Conservation Actions (continued)
1°	Provide long term protection for bald eagle habitats associated with the Maurice River, including land acquisition and protections from human disturbance. <i>(Conserve wildlife – rare wildlife)</i>
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available. <i>(Protect habitat – Landscape Project)</i>
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, land acquisition priorities, and development of management strategies for permanently protected lands. <i>(Protect habitat – Landscape Project)</i>
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. <i>(Corridors – migratory birds; Protect habitat – migratory birds)</i>
1°	NJDFW to develop guidelines for recommended deer densities compatible with enhancing forest health, generally by increasing deer harvest on public lands and adjacent private lands. <i>(Conserve wildlife – deer, rare wildlife)</i>
1°	Identify and implement best management practices to maintain and enhance the Maurice River as a significant bald eagle and raptor wintering area. <i>(Conserve wildlife – rare wildlife)</i>
1°	Identify waterfowl and snow goose concentration areas and incorporate into habitat protection and enhancement programs. <i>(Conserve wildlife – game species)</i>
1°	Determine summer range and habitat use for Indiana bats and other forest bats, and use the information to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., landowner incentives for protecting habitat, and public education regarding importance of bat conservation). <i>(Conserve wildlife – rare wildlife; Protect habitat – Landscape Project)</i>
1°	Determine status of margined madtom (and other listed/rare fish) in the region and seek Category One antidegradation designations in waterways where it occurs. <i>(Native wildlife – fish; Protect habitat – fish)</i>
1°	Identify and map significant natural vegetative communities, particularly on public lands and lands that serve as wildlife corridors. <i>(Conserve wildlife – rare wildlife)</i>
Prevent, stabilize, and reverse declines of rare forest wildlife	
1°	Develop and implement proactive species recovery plans for all endangered and threatened species. Develop and implement proactive habitat conservation that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagles. <i>(Conserve wildlife – rare wildlife)</i>
1°	Identify and implement best management practices for bald eagles, forest-interior passerines and raptors, ospreys. <i>(Conserve wildlife – rare wildlife)</i>

1

Priority	Conservation Actions (continued)
1°	Develop habitat conservation goals that will meet the recovery needs of endangered and threatened wildlife populations that depend on forest habitats. These include guidelines for forest silviculture on public and private lands to enhance forest maturity and canopy, and replanting to reduce fragmentation. <i>(Protect habitat – Landscape Project; Silviculture – land management; Enhance habitat – private lands)</i>
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including causes and effects of habitat loss and degradation, disturbance, contaminants, predation, food availability, and invasive plants. <i>(Protect habitat – sprawl, recreational vehicles; Conserve wildlife – invasives, contaminants)</i>
1°	Protect corn snake and northern pine snake populations from illegal collection through law enforcement and public education. <i>(Protect wildlife - humans)</i>
1°	Determine habitat use by forest bats (including Indiana bat), and incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., landowner incentives for protecting habitat, and public education regarding importance of bat conservation). <i>(Protect habitat – Landscape Project)</i>
1°	Prohibit off-road vehicles from all critical wildlife habitats, public and private conservation lands. <i>(Protect habitat – recreational vehicles; Conserve wildlife - recreational vehicles)</i>
2°	Continue to investigate habitat requirements for forest passerines and raptors, corn snakes, northern pine snakes, Cope's gray treefrogs, and Pine Barrens treefrogs. Research and experimentally implement planned silviculture to develop guidance for enhancing forests for forest-interior birds, corn snakes and northern pine snakes. <i>(Protect habitat – Landscape Project; Silviculture – land management)</i>
2°	Investigate the impact of land use patterns on Pine Barrens treefrog, N. pine snake and corn snake populations. <i>(Protect habitat – sprawl; Corridors - sprawl)</i>
2°	Develop management guidelines for private landowners with significant bald eagle and interior-forest bird populations. <i>(Conserve Wildlife – rare wildlife)</i>
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. <i>(Conserve wildlife – deer; Evaluate restoration - deer)</i>
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. <i>(Evaluate restoration – deer; Conserve wildlife – rare wildlife)</i>
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer. <i>(Conserve wildlife - deer)</i>

Priority	Conservation Actions (continued)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. Species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
1°	Act to control the spread of Phragmites in the tidal Maurice River. (<i>Conserve wildlife – invasives</i>)
1°	Maintain and enhance wild rice marshes in the tidal Maurice River by minimizing vegetative damage by resident Canada geese. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
1°	Identify areas through surveys and public participation where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical or biological control measures to eradicate invasive plants in areas identified as critical habitat for endangered, threatened or priority wildlife that are threatened by invasive, non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Identify conflicts and benefits of habitat use posed by abundant and concentrated snow geese to nesting waterfowl and migratory shorebirds.
Protect and enhance wetland and open water habitats	
1°	Determine optimal biological buffers for wetlands and waterways, and implement around critical wetland and riparian areas. (<i>Protect habitat – Landscape Project</i>)
1°	Determine presence and habitat parameters of rare fish (e.g., margined madtom) and recommend management and protection guidelines. (<i>Native wildlife – fish; Protect habitat – fish; Monitor wildlife – fish</i>)
2°	Remove obstructions to fish passage in rivers and streams. (<i>Protect habitat – fish</i>)
2°	Locate potential vernal pools and integrate certified vernal pools into DEP regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
2°	Identify and research water quality parameters for rare species such as bald eagle, osprey, special concern amphibian, and rare dragonfly and damselfly populations.
Protect and enhance habitats for scrub-shrub communities	
1°	Act to protect, maintain, and/or enhance habitats that support populations of bronze copper, frosted elfin, and scrub-shrub birds, particularly at locations where early-successional habitats are maintained for (other) primary purposes. (<i>Conserve wildlife – rare wildlife</i>)
1°	Manage rights-of-way for frosted elfins and other scrub-shrub species with small area requirements. Target land acquisition to add important forest tracts to state ownership. (<i>Conserve wildlife – rare wildlife</i>)
1°	Maintain existing grassland and scrub-shrub habitats and work to establish new grasslands or scrub/shrub habitats along utility-line rights-of-way.

1

Priority	Conservation Actions (continued)
Maintain and enhance bald eagles, ospreys and northern harriers	
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagle. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Identify and implement best management practices to maintain and enhance the Maurice River as a significant bald eagle and raptor wintering area. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
2°	Identify and research water quality parameters for bald eagle, osprey, spotted turtle, special concern amphibian, and rare dragonfly and damselfly populations.
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Determine carrying capacity of area marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for migratory and wintering waterfowl populations of conservation concern. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species; Protect habitat – Landscape Project</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl of conservation concern, seeking areas where such management complements rare species management. (<i>Conserve wildlife – game species</i>)
Inventory and monitor forest-dependent wildlife	
1°	Survey suitable habitats to determine distribution of forest wildlife of conservation need and establish baseline information and long-term trends. Annually survey and monitor bald eagle nesting and production. Survey and monitor ospreys every two years, woodland raptors and passerines every four years. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Protect habitats through innovative public and private partnerships. Promote landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant populations of bald eagles, forest-interior wildlife, and rare amphibian and invertebrate populations.
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks), northern saw-whet owls, and eastern screech-owls. (<i>Monitor wildlife – long-term monitoring</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
Identify and survey habitats for rare invertebrate wildlife	
1°	Conduct searches for frosted elfins, bronze coppers, and Hessel's hairstreaks. Develop and implement BMPs for frosted elfin and scrub-shrub bird communities on powerlines. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Identify and research water quality parameters for bald eagle, osprey, spotted turtle, special concern amphibian, and rare dragonfly and damselfly populations.
Prevent illegal collection of rare reptiles and amphibians	
1°	Protect corn snake and northern pine snake populations from illegal collection. (<i>Protect wildlife - humans</i>)
1°	Notify wildlife law enforcement agents of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes) and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
Stabilize and reverse declines of aquatic wildlife and rare fish species	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Native wildlife – fish; Protect habitat – fish, Monitor wildlife - fish</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Native wildlife – fish</i>)
1°	Develop a fish Index of Biotic Integrity (IBI) to better assess, restore and protect NJ's non-trout streams in the Lower Delaware River drainage. (<i>Monitor wildlife - fish</i>)
1°	Seek Category One antidegradation classifications in water bodies where listed or special concern species occur, or where there are high levels of biological integrity based on fish assemblage. Seek other appropriate classifications for stream segments based on IBI results. (<i>Monitor wildlife – fish; Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
Identify and protect habitat for Indiana bats and other forest dwelling bat species	
1°	Determine summer range and habitat use for Indiana bats and other forest dwelling bat species. Use data to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., providing landowner incentives for enhancing and protecting habitat, promoting public education regarding importance of bat conservation). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
2°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Research and restore populations of timber rattlesnake and bobcat	
2°	Investigate the habitat suitability and techniques for restoring bobcats to this zone. Conduct presence/absence surveys for bobcat using scent-post surveys within suitable habitat. (<i>Conserve wildlife – rare wildlife</i>)
2°	Survey suitable habitats to determine presence and distribution of timber rattlesnakes. Encourage landowners to report timber rattlesnake sightings. Monitor habitat use and survival of encountered animals using radio-telemetry to locate dens and identify critical habitats. (<i>Conserve wildlife – rare wildlife; Monitor wildlife – long-term monitoring</i>)
2°	Notify wildlife law enforcement agents of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection and human disturbance and off-road-vehicles. (<i>Protect habitat – humans; Protect habitat – recreational vehicles</i>)
Promote public education and awareness and wildlife conservation	
1°	Identify and implement best management practices to maintain and enhance the Maurice River as a significant bald eagle and raptor wintering area. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species.
2°	Develop and maintain education materials and viewing opportunities for the public. (<i>Education – humans</i>)
2°	Encourage native plant use in landscaping through public awareness and landscaping companies, as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)

2

3 **f. Potential Partnerships to Deliver Conservation**

4 Private Landowners

- 5 • Protect and enhance habitat through innovative partnerships with private landowners.
- 6 ○ Implement best management practices that protect and enhance habitat for forest
- 7 birds, bald eagles, forest passerines and raptors.
- 8 ○ Develop and implement incentive programs that encourage the management of forest
- 9 communities.
- 10 ○ Through incentive programs, target private landowners adjacent to public natural
- 11 lands to manage land for mature forest in order to increase effective size and
- 12 connectivity of forest patches.
- 13 ○ Encourage farmers to preserve farmland through conservation easements through
- 14 partnerships with the DEP's Green Acres Program, The Nature Conservancy–NJ

Chapter, Natural Lands Trust, and local municipalities for the conservation of forest communities.

- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.
- Work with landowners to maintain/enhance existing habitats where special concern fish species occur.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups (NJ Audubon Society, The Nature Conservancy-NJ Chapter, NJ Conservation Foundation, Natural Lands Trust) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
 - Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas and building osprey nest structures.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
- Promote backyard habitat management for migratory raptors and passerines, and for vernal pools where appropriate.
- Collaborate with NJ Audubon Society to educate public on the effects of feral cats on wildlife species of conservation concern.

Wildlife Professionals

- Collaborate with researchers in Delaware, Maryland, Virginia, New York, and Pennsylvania to continue to develop best management practices and conservation plans for bald eagle nesting, foraging and wintering areas.
- Consult with entomologists to design and conduct surveys for listed and rare invertebrates in appropriate habitats, then develop best management practices and conservation plans.

Conservation Organizations

- Partner with Citizens United to Protect the Maurice River and its Tributaries and other conservation organizations such as NJ Audubon Society (NJAS), The Nature Conservancy-NJ Chapter (TNC) and NJ Conservation Foundation (NJCF) to protect and enhance habitats for rare species.
 - Work with TNC, NJAS, and NJCF to protect and enhance large tracts of contiguous forest, especially those adjacent to state lands.
 - Work with TNC and Citizens United to manage and protect bald eagle, osprey and raptor nesting and wintering areas.
 - Protect and enhance sites hosting significant populations of rare Odonates and Lepidopterans on conservation lands.
- Work with Citizens United to Protect the Maurice River and its Tributaries to develop local wildlife festivals and educational programs such as classroom curricula.

- Encourage the use of the Landscape Project’s critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other farm conservation programs.
- Work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.
- Partner with The Nature Conservancy–NJ Chapter to protect and enhance critical habitat where listed or special concern fish and wildlife species occur.

Academic Institutions

- Partner with Rutgers and other academic institutions to conduct studies necessary to better understand the impacts of deer on biodiversity, forest health, and ecosystem processes and to develop habitat-specific or landscape-specific deer density targets.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USDA-NRCS, USFWS, National Park Service (NPS), and the DCA, Office of Smart Growth, to protect, enhance, and create habitats, and to protect NJ’s native wildlife.
 - NJ Department of Environmental Protection’s (DEP) Division of Fish and Wildlife (DFW) to maintain and protect bald eagle, osprey, and interior-forest bird nesting and foraging sites.
 - NJ and USFWS to develop a plan with state and federal wildlife law enforcement agents to protect sensitive endangered/threatened species areas from disturbance.
 - DFW and DEP’s Division of Parks and Forestry (DPF) to work with the DEP’s Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant natural vegetative communities, particularly on public lands and lands that serve as wildlife corridors, to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
 - DFW and DPF to collaborate on forest management guidelines to achieve forest management goals for listed and rare wildlife, on both public and private lands.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bald eagle sites.
 - DFW and conservation organizations to work with DEP’s Land Use Regulation Program (LURP) to protect vernal pools and appropriately classify wetlands for Pine Barrens treefrog, Cope’s gray treefrog, eastern tiger salamander, and rare dragonfly and damselfly populations.
 - Expand efforts to create habitat and implement best management practices for forest passerines and raptors, forest reptiles, and bald eagles on state lands and with natural resource managers, county and municipal utility authorities and planners.
 - Implement best management practices for scrub-shrub wildlife on power lines that cross Wildlife Management Areas and conservation lands, via the state permit process and direct communications with utility companies.

- DFW to lead in the development of specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW to work with state and county mosquito commissions to reduce the use of deleterious insecticides and biological controls at known amphibian breeding sites.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to work with USFWS and other state, federal, and non-governmental partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan, seeking areas where such management complements rare species management.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW to develop guidelines for wildlife buffers with DEP's Division of Watershed Management, Bureau of Water Monitoring and Standards, and others, for important riparian and floodplain areas such as the Maurice River and its tributaries. Partner with them to investigate water quality and reduce threats of contaminants/pollution.
- Improve habitat protection by partnering with the National Park Service's office for the Wild and Scenic River.
- DFW to determine groundwater recharge areas for vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW will work with DEP's Bureau of Water Monitoring and Standards to recommend appropriate stream classifications.
- DFW to lead in the development of educational materials for public and private landowners about forest-dependent wildlife and nesting and wintering bald eagles and their habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs, wildlife festivals, and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee Farmland Preservation, local land trusts, and through mitigation.

- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Annually monitor abundance, productivity, distribution, and trends of bald eagle, osprey (biannually), forest passerine and raptor populations, listed and special concern amphibian and reptile populations. Compare vegetation parameters and populations between managed/protected sites and non-managed sites to provide feedback into management strategies.
- Monitor contaminant levels that might impact bald eagle and osprey populations.
- Monitor species abundance of migratory raptors at key locations to determine migration count trends.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

3. Tuckahoe River Watershed

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring success*

a. Habitats

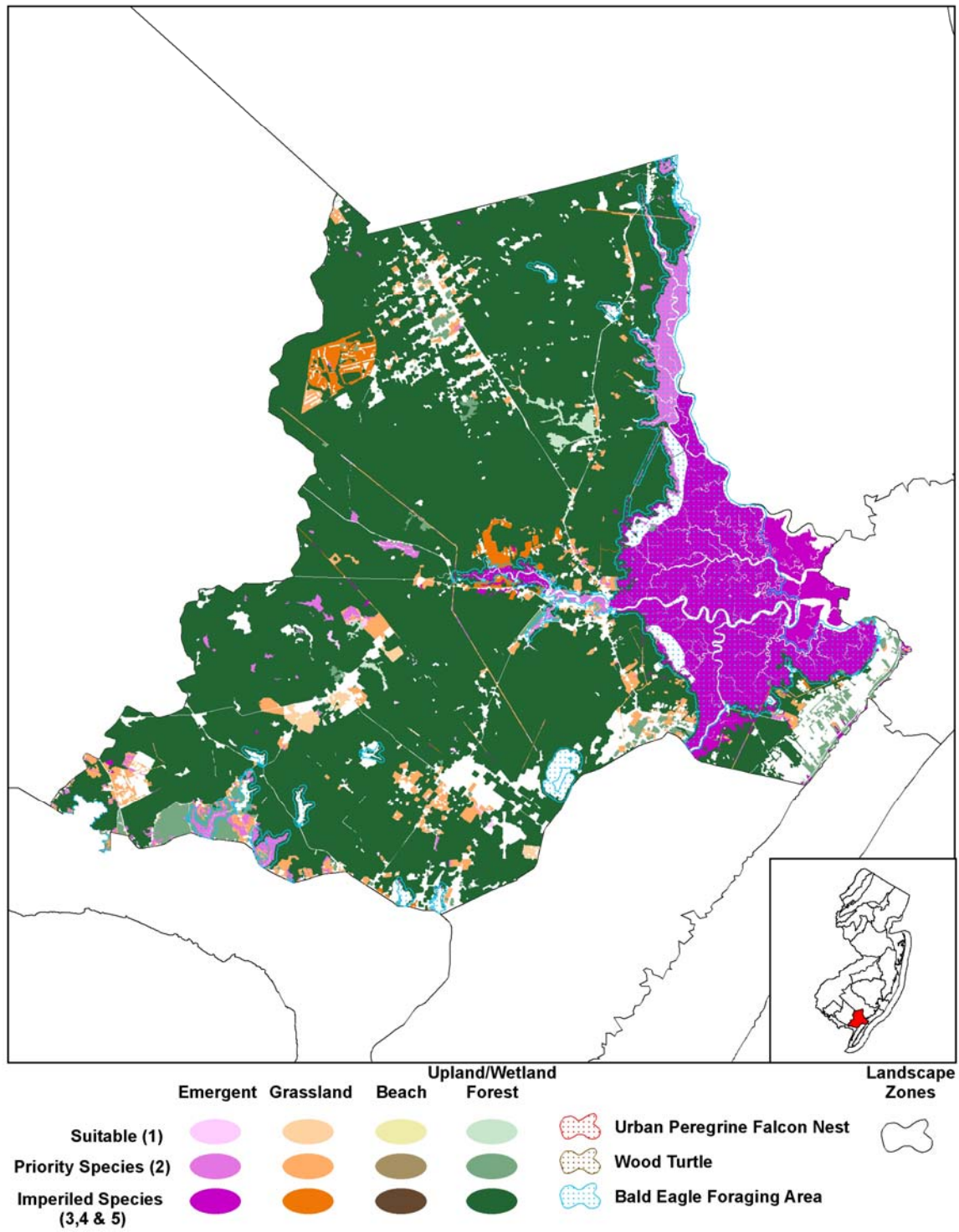
The Tuckahoe River Watershed fans upstream from Great Egg Harbor's open waters to the expansive marshes and lowland forests of Tuckahoe WMA, the Atlantic white cedar swamps, mixed hardwood swamps, and oak-hickory forest of Belleplain State Forest (Figure 14). It also includes parts of the pine-oak forests of Peaslee WMA, as well as the Corbin City WMA and Great Egg Harbor Greenway land.

b. Wildlife of Greatest Conservation Need

In the diverse array of habitats in the Tuckahoe River Watershed, of highest importance are forested uplands and wetlands. This zone is similar in many ways to the Maurice River zone in that it provides large, contiguous forest essential to southern New Jersey's forest bird populations, including barred owls and red-shouldered hawks. If these species are to thrive in southern New Jersey, the large forests of the Tuckahoe and Maurice River areas must be preserved and enhanced. This goal will also serve to support the large autumn bird migration through the Cape May Peninsula to the south, where habitat loss is seriously threatening this nationally important migration.

The wildlife of the Tuckahoe River Watershed includes one federal threatened, five state endangered, 10 state threatened, and 66 special concern/regional priority species. The diverse forested wetlands and upland forests support bald eagles, cavity-nesters, forest passerines, scrub-shrub/open field birds, northern pine snakes, timber rattlesnakes, Cope's gray treefrogs, eastern tiger salamanders, Pine Barrens treefrogs, and frosted elfins. Open saltwater, impounded coastal marshes, tidal marshes and creeks of the Tuckahoe River are foraging habitat for bald eagles, common terns, ospreys, peregrine falcons, red knots and other migratory shorebirds, northern harriers and other coastal marsh birds, and foraging colonial waterbirds. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, are suspected to occur here. Tables DB22 – DB28 identify the species of greatest conservation need within this zone.

1 **Figure 14.** Critical landscape habitats within the Tuckahoe River Watershed conservation zone,
 2 as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of Tuckahoe River Watershed

Table DB22. Federal Endangered Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle		X	X	X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

X: Species occurs within the identified habitat.

Table DB23. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				R
Birds				
American bittern		R		
Least tern		X		
Northern harrier		X	X	
Peregrine falcon		X		
Red-shouldered hawk				X
Reptiles				
Timber rattlesnake				R
Amphibians				
Cope's gray treefrog		X		X
Eastern tiger salamander				X

R: Proposed research and/ or reintroduction of species.

X: Species occurs within the identified habitat.

Table DB24. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night heron		X		
Cooper's hawk				X
Long-eared owl				X
Osprey		X		
Red-headed woodpecker				X
Yellow-crowned night heron		X		
Reptiles				
Northern pine snake				X
Amphibians				
Pine Barrens treefrog		X		X
Insects				
Frosted elfin		X	X	X

X: Species occurs within the identified habitat.

Table DB25. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				X*
Hoary bat				X*
Silver-haired bat				X*
Southern bog lemming			X	X
Birds				
Acadian flycatcher				X
American kestrel			X	

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
American oystercatcher		X		
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blackburnian warbler				X
Black-throated green warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Canada warbler				X
Cattle egret		X	X	
Chimney swift			X	
Chuck-will's-widow				X
Common barn owl			X	
Common tern		X		
Eastern kingbird			X	X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-peewee				X
Field sparrow			X	
Forster's tern		X		
Glossy ibis		X		
Gray catbird			X	X
Great blue heron		X		
Great crested flycatcher				X
Great egret		X		
Green heron		X		
Hooded warbler				X
Indigo bunting			X	
Kentucky warbler				X
King rail		X		
Least bittern		X		
Least tern		X		
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Rose-breasted grosbeak				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Sharp-shinned hawk				X
Snowy egret		X		
Spotted sandpiper		X		
Tri-colored heron		X		
Veery				X
Whip-poor-will				X
Willet		X		
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Reptiles (continued)				
Eastern kingsnake				X
Northern diamondback terrapin		X		
Spotted turtle		X		X
Amphibians				
Carpenter frog		X		X
Fowlers toad		X		X
Marbled salamander		X		X
Insects				
A noctuid moth, <i>Meropleon cosmion</i>		X		
Chain fern borer moth, <i>Papaipema stenocelis</i>				X
Pine Barrens bluet, <i>Enallagma recurvatum</i>		X		
Precious underwing, <i>Catocala pretiosa pretiosa</i>				X
Rare skipper, <i>Problemata bulenta</i>				X
Regal moth, <i>Citheronia regalis</i>				X
Rippled wave, <i>Idaea obfusaria</i>			X	
Scarlet bluet, <i>Enallagma pictum</i>		X	X	
Fish				
Atlantic sturgeon	X			

*Potential presence.

X: Species occurs within the identified habitat.

Table DB26. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock				X
Bufflehead	X	X		
Canada Goose (Atlantic population)	X	X		
Canvasback	X	X		
Clapper rail		X		
Greater scaup	X	X		
Lesser scaup	X	X		
Northern bobwhite quail			X	X
Northern pintail	X	X		
Virginia rail		X		
Wood duck		X		

X: Species occurs within the identified habitat.

Table DB27. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table DB28. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Tuckahoe River Watershed

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Fragmentation and loss of forest habitats are the greatest threats in this area. Expanding development associated with residential development for a growing human population is the main cause, particularly in Upper Township. Sand and gravel operations have created large gaps in habitats, and threaten to impinge further on upland and swamp forests. Recreational activities such as off-road vehicle use in Belleplain SF and Peaslee WMA disturb and degrade habitats for forest species. Aggressive forest harvest actions on Belleplain SF may threaten forest-interior nesting birds by creating openings that promote invasive and competing species, and by creating even-aged stands that depress wildlife diversity. Pressure on groundwater resources threatens Cope's gray treefrogs and other amphibians that depend on high quality breeding pools. Illegal off-road vehicles damage sensitive habitats, including vernal pools and wetlands, and are a particular problem on public lands. Contaminants (primarily organochlorines) from unknown sources continue to be detected in the area's bald eagles, ospreys and peregrine falcons. Invasive plants and animals threaten the ecological integrity of habitats in the region. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, enhance, and restore large contiguous tracts of forests for long-term viability of large-area and mature forest birds, primarily barred owl and red-shouldered hawk. Maintain and enhance (where necessary) the connections of these forests to the Maurice River and Cape May Peninsula zones, as well as to the Pinelands landscape region.
- Prevent, stabilize, and reverse declines of forest interior wildlife. Stabilize populations of northern pine snakes, frosted elfins, coastal marsh birds, colonial waterbirds, migratory birds, freshwater wetland birds, and listed and special concern reptiles and amphibians, where most appropriate.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Inventory, determine distribution, and monitor forest interior birds, bald eagles, and marsh nesting and foraging birds, rare amphibian and reptile populations, and other rare wildlife.
- Maintain bald eagle, osprey, peregrine falcon, northern harrier, northern pine snake and Pine Barrens treefrog populations.

- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Identify and protect vernal pools and other wetlands to maintain viable populations of Cope's gray treefrog and eastern tiger salamander, and support Pine Barrens treefrog populations.
- Identify and protect freshwater and tidal salt marsh habitats for wintering and foraging bald eagles, nesting ospreys and peregrine falcon, nesting rails, foraging colonial waterbirds and waterfowl, and migratory shorebirds. Identify forested areas adjacent to riverine and tidal marshes necessary to maintain and expand bald eagle nesting and wintering populations.
- Identify, protect, and enhance small habitats and alternative-purpose habitats (e.g., rights-of-way) to benefit forested elfin populations and scrub-shrub bird communities.
- Support the restoration of coastal marsh bird populations by recognizing and enhancing foraging habitats.
- Protect, maintain, and enhance critical aquatic habitats to preserve populations of endangered, threatened, and special concern fish species.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife
- Research and restore populations of timber rattlesnakes and bobcats. Bobcats might be present in this zone but targeted research of habitat suitability is needed.
- Prevent illegal collection of rare reptiles and amphibians.
- Identify and protect summer roosting habitat for Indiana bats and other forest-dwelling bat species.
- Promote public education and awareness and wildlife conservation

e. Conservation Actions

Priority	Conservation Actions
Protect large contiguous tracts of forests	
1°	Continue to identify critical core forests and assess their condition for forest-nesting birds and bald eagles, and maintain information in the Landscape Project and Biotics database. Identify protection strategies (e.g., landowner incentives and acquisition) to maintain large core areas in perpetuity. Identify adjacent habitats that can be managed to enhance the total size of forest habitat. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available. (<i>Protect habitat – Landscape Project</i>)
1°	Protect habitats through innovative public and private partnerships. Promote landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle and forest-interior wildlife sites. (<i>Protect habitat – Landscape Project</i>)

Priority	Conservation Actions (continued)
1°	Act to protect, maintain, enhance, create, and/or restore forest habitat. Manage forests for larger, more mature woodlands with large trees for cavity-nesters and with a canopy closure of >80%. Maintain and enhance floodplain forests for forest passerines. Manage forest habitats for woodland raptor and passerine suitability. Promote maturity in second-growth forested wetlands of moderate wildlife value to create future barred owl and red-shouldered hawk habitat. Target land acquisition to add important forest and field tracts to state ownership. (<i>Protect habitat – Landscape Project; Silviculture – land management</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, land acquisition priorities, and development of management strategies for permanently protected lands. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project; Corridors – migratory birds</i>)
1°	Collaborate with Division of Parks and Forests to enhance Belleplain State Forest for wildlife: uneven-age stand management, preserve standing and fallen dead biomass, eliminate forestry practices in wetland forests and manage adjacent upland forest for older-growth. (<i>Silviculture – land management; Protect habitat – Landscape Project</i>)
Prevent, stabilize, and reverse declines of rare forest wildlife	
1°	Develop and implement proactive species (and habitat) recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagle. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>) Implement plans for colonial waterbirds and freshwater wetland birds (consistent with the North American Waterbird Conservation Plan), and plans for amphibian and reptile populations (consistent with NE Amphibian and Reptile Conservation). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring</i>)
1°	Develop habitat conservation goals that will meet the recovery needs of endangered and threatened wildlife populations that depend on forest habitats. (<i>Conserve wildlife – rare wildlife; Silviculture – land management</i>)
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and degradation, disturbance, predation, contaminants, food supply availability, and invasive plants. (<i>Conserve wildlife – invasives, cats, subsidized predators, contaminants; Protect habitat – sprawl, recreational vehicles</i>)
1°	Identify and implement best management practices for bald eagle, forest-interior passerines and raptors. Promote landowner incentives for protecting and managing wildlife habitat; develop landowner cooperative agreements. (<i>Conserve wildlife – rare wildlife</i>)

Priority	Conservation Actions (continued)
1°	Protect northern pine snake populations from illegal collection. (<i>Protect wildlife - humans</i>)
1°	NJDFW to develop guidelines for recommended deer densities that are compatible with reversing declines of priority forest birds and increase deer harvest on public lands through special hunts and adjacent private lands through municipal deer management plans. (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)
1°	Prohibit off-road vehicles from all critical wildlife habitats, public and private conservation lands. (<i>Protect habitat – recreational vehicles</i>)
1°	Determine summer range and habitat use for Indiana bats and other forest bats, and use the information to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., landowner incentives for protecting habitat, and public education regarding importance of bat conservation). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Continue to investigate habitat requirements for forest passerines and raptors, bald eagles, northern pine snakes, Cope’s gray treefrogs, and eastern tiger salamanders. Research and experimentally implement planned silviculture to develop guidance for enhancing forests for forest-dependent birds. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project; Silviculture – land management</i>)
Prevent, stabilize, and reverse declines of rare fish species	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish; Monitor wildlife - fish</i>)
Inventory, determine distribution, and monitor rare wildlife and fish species	
1°	Survey suitable habitats to determine distribution of forest wildlife of greatest conservation need and establish baseline information and trends. Survey and monitor bald eagle nesting and production. Annually survey and monitor ospreys every two-three years, woodland raptors and passerines every four years. Develop indices to monitor productivity of forest birds, especially listed and indicator species. Survey and monitor vernal pool habitats and populations. (<i>Conserve wildlife – rare wildlife</i>)
1°	Conduct searches for frosted elfins, bronze coppers, and Hessel’s hairstreaks. Develop and implement BMPs for frosted elfin and scrub-shrub bird communities on powerlines. (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will’s-widows, common nighthawks), northern saw-whet owls, and eastern screech-owls. (<i>Conserve wildlife – rare wildlife; Monitor wildlife – long-term monitoring</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Status – fish; Protect habitat – fish; Monitor wildlife - fish</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)

Priority	Conservation Actions (continued)
Maintain bald eagle, osprey, peregrine falcon, northern harrier, northern pine snake, and Pine Barrens treefrog populations	
1°	Identify and implement best management practices to maintain and enhance the Tuckahoe River as a significant bald eagle and raptor wintering area. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Identify and implement best management practices for northern harriers and ospreys in the tidal marsh habitats. (<i>Conserve wildlife – rare wildlife</i>)
1°	Protect habitats through innovative public and private partnerships. Promote landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, forest-interior wildlife, and rare amphibian and invertebrate populations. (<i>Protect habitat – Landscape Project</i>)
1°	Continue to investigate terrestrial habitat requirements for northern pine snakes, Cope's gray treefrogs, eastern tiger salamanders, and Pine Barrens treefrogs, and recommend appropriate management and regulations based on the results. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Develop management guidelines for private landowners with significant forest bird areas, bald eagle, rare amphibian, and freshwater wetland bird populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Investigate the impact of land use patterns on Pine Barrens treefrog populations. (<i>Protect habitat - sprawl</i>)
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Determine carrying capacity of area marshes for wintering black ducks. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Identify critical habitats and assess their condition for migratory and wintering waterfowl populations of conservation concern. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl of conservation concern, seeking areas where management complements rare species management. (<i>Conserve wildlife – game species</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)

Priority	Conservation Actions (continued)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to meet forest health goals. (<i>Conserve wildlife – deer; Evaluate restoration – deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer.
1°	Survey and monitor for the spread of invasive insect species that jeopardize forest health. Species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
1°	Control herbivory damage from mute swans in impoundments managed for shorebirds and waterfowl. (<i>Conserve wildlife – invasives</i>)
1°	Investigate the need to control Phragmites within Tuckahoe River wetlands to maintain and enhance natural vegetative communities. (<i>Conserve wildlife – invasives</i>)
1°	Identify areas through surveys and public participation where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical or biological control measures to eradicate invasive plants in areas identified as critical habitat for endangered, threatened or priority wildlife that are threatened by invasive, non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
Identify and protect vernal pools and other wetlands	
1°	Maintain vernal pool identification and survey project to certify vernal pools and monitor amphibian populations therein. (<i>Conserve wildlife – rare wildlife</i>)
1°	Maintain larger buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat – fish, mussels</i>)
2°	Identify and research water quality parameters for vernal pool obligate and facultative species.
Priority	Conservation Actions (continued)
Identify and protect freshwater and salt marsh habitats	
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on freshwater and salt marsh wildlife habitat requirements are available. (<i>Protect habitat – Landscape Project</i>)
Identify, protect, and enhance habitats for scrub-shrub communities	
1°	Manage rights-of-way for frosted elfin and scrub-shrub species with small area requirements. Develop and implement BMPs for rights-of-way that benefit these species (esp. frosted elfin and early-successional birds). (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)

1

Priority	Conservation Actions (continued)
1°	Promote landowner incentives and manager cooperation to protect and enhance local populations of frosted elfins (e.g., on powerlines), and scrub-shrub/open field birds (e.g., on airports). (<i>Conserve wildlife – rare wildlife; Other practices – land management</i>)
1°	Act to protect and/or maintain habitats that support frosted elfin populations and scrub-shrub bird communities. (<i>Conserve wildlife – rare wildlife</i>)
1°	Maintain existing grassland and scrub-shrub habitats and work to establish new grasslands or scrub/shrub habitats along utility-line rights-of-way. (<i>Conserve wildlife – rare wildlife</i>)
Support the restoration of coastal marsh bird populations	
1°	Investigate the creation of a marine conservation zone to manage disturbance and other threats. (<i>Conserve wildlife - recreational vehicles; Evaluate restoration - recreational vehicles</i>)
1°	Promote best management practices in marshes, including management for native vegetation and mosquito control beneficial to coastal birds. (<i>Other practices – land management</i>)
Protect, maintain, and/or enhance critical aquatic habitat of rare fish species	
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Protect habitat – fish</i>)
1°	Maintain the NJDEP-DFW, Bureau of Freshwater Fisheries' FishTrack Database and determine distributions of fishes identified as special concern by the Delphi process. (<i>Native wildlife – fish; Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Protect habitat – Landscape Project; Monitor wildlife - fish</i>)
Research and restore populations of timber rattlesnake and bobcat	
2°	Investigate the possible techniques for restoring these species. (<i>Conserve wildlife – rare wildlife</i>)
2°	Investigate the habitat suitability and techniques for restoring bobcats to this zone. Conduct presence/absence surveys for bobcat using scent-post surveys within suitable habitat. (<i>Conserve wildlife – rare wildlife</i>)
2°	Survey suitable habitats to determine presence and distribution of timber rattlesnakes within this conservation zone. Encourage landowners to report timber rattlesnake sightings. Monitor habitat use and survival of encountered animals using radio-telemetry to locate dens and identify critical habitats. (<i>Conserve wildlife – rare wildlife</i>)
2°	Enhance communication that enables law enforcement to implement stringent enforcement of endangered species laws at critical sites (nesting, basking, gestation, dens), including protection of wildlife from illegal collection and human disturbance and off-road-vehicles. (<i>Protect wildlife – humans; Protect habitat – recreational vehicles</i>)

Priority	Conservation Actions (continued)
Prevent illegal collection of rare reptiles and amphibians	
1°	Protect northern pine snake populations from illegal collection. (<i>Protect wildlife – humans</i>)
1°	Notify wildlife law enforcement agents of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes) and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans; Protect habitat – recreational vehicles</i>)
Identify and protect habitat for Indiana bats and other forest dwelling bat species	
2°	Determine summer range and habitat use for Indiana bats and other forest dwelling bat species. Use data to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., providing landowner incentives for enhancing and protecting habitat, promoting education on importance of bat conservation). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
2°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999).
Promote public education and awareness and wildlife conservation	
1°	Raise public awareness of the Tuckahoe River as a significant bald eagle and raptor wintering area. (<i>Education – humans</i>)
2°	Educate public about the importance of these habitats to the Atlantic coast migration. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)
2°	Develop and maintain educational materials and viewing opportunities for the public. (<i>Education – humans</i>)
2°	Encourage native plant use in landscaping through public awareness and landscaping companies, as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect and enhance habitat for forest birds, bald eagles, forest passerines and raptors, and coastal marsh birds.
 - Utilize incentive programs that encourage the management of forest communities.
 - Through incentive programs, target private landowners surrounding public natural lands to manage land for forests in order to increase effective size and connectivity of forest patches.

- Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, The Nature Conservancy, Natural Lands Trust, and local municipalities for the conservation of forest communities.
- Work with landowners to maintain/enhance existing habitats where listed special concern fish species occur.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Involve Citizen Scientists in monitoring and management projects, such as protection and posting of bald eagle nesting areas, surveying forest birds, and building osprey nest structures.
 - Recruit North American Butterfly Association volunteers to conduct surveys for rare butterfly and moth species.
- Promote backyard habitat management for resident and migratory birds, and for vernal pools where appropriate.
- Collaborate with NJ Audubon Society to educate public on the effects of feral cats on wildlife species of conservation concern.

Wildlife Professionals

- Collaborate with researchers in Delaware, Maryland, Virginia, New York, and Pennsylvania to continue to develop best management practices and conservation plans for bald eagle nesting, foraging and wintering areas.
- Consult with entomologists to design and conduct surveys for listed and rare invertebrates in appropriate habitats, then develop best management practices and conservation plans.

Conservation Organizations

- Partner with watershed and conservation organizations such as NJ Audubon Society (NJAS) and The Nature Conservancy (TNC) to protect and enhance habitats for rare species.
 - Protect and enhance large tracts of contiguous forest; focus acquisition and protection adjacent to Tuckahoe, Belleplain and Peaslee state lands.
 - Protect bald eagle, osprey, and raptor nesting, foraging and wintering areas.
 - Identify, protect and enhance sites hosting significant populations of rare dragonflies, damselflies, butterflies, and moths.
- Consult with conservation organizations to develop educational programs such as classroom curricula and wildlife festivals.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.

- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other farm conservation programs.
- NJDFW to partner with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.

Academic Institutions

- Partner with Rutgers and other academic institutions to conduct studies necessary to better understand the impacts of deer on biodiversity, forest health, and ecosystem processes and to develop habitat-specific or landscape-specific deer density targets.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USDA-NRCS, USFWS, and the DCA, Office of Smart Growth to protect, enhance, and create habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to maintain and protect bald eagle and interior-forest bird nesting and foraging sites, with special focus on Tuckahoe, Peaslee and Belleplain state lands.
 - Expand efforts to create habitat and implement best management practices for forest passerines and raptors, forest reptiles, and bald eagles on state lands with DFW and DEP's Division of Parks and Forestry (DPF), and with natural resource managers, county and municipal utility authorities and planners.
 - DFW and DPF to work with the DEP's Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant natural vegetative communities, particularly on public lands and lands that serve as wildlife corridors, to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
 - DFW and DPF to collaborate on forest management guidelines to achieve forest management goals for listed and rare wildlife, on both public and private lands.
 - DFW to develop a plan with wildlife law enforcement agents to protect sensitive endangered/threatened species areas from disturbance.
 - DFW to coordinate with state and federal law enforcement to maintain adequate surveillance of bald eagle sites.
 - Implement best management practices for scrub-shrub wildlife on power lines that cross Wildlife Management Areas, State Forests, and conservation lands.
 - Encourage greater buffers for important riparian and floodplain areas such as the Tuckahoe and associated rivers with Division of Watershed Management. Partner with them to investigate water quality and threats of contaminants/pollution.
 - DFW and conservation organizations to work with the DEP's Land Use Regulation Program work to identify and protect vernal pools and appropriately classify wetlands for Cope's gray treefrogs, eastern tiger salamanders, Pine Barrens treefrogs, and rare invertebrate populations.
 - DFW and other agencies to promote the establishment of marine conservation areas in critical salt marsh habitats.
 - DFW to lead in the development of specific conservation plans for special concern reptiles and amphibians on state lands.

- DFW to work with state and county mosquito commissions to reduce the use of deleterious insecticides and biological controls at known amphibian breeding sites.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with the Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with USFWS and other state, federal, and non-governmental partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan, seeking areas where such management complements rare species management.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS), to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to determine groundwater recharge areas for Cope's gray treefrog sites and vernal pools with the Division of Water Quality (DWQ) and the NJ Geological Survey. NJDFW to work with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to lead in the development of educational materials for the public and private landowners about the importance of the area for forest birds, bald eagles, and marsh birds, as well as the fall bird migration.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs, wildlife festivals, and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Annually monitor abundance, productivity, distribution, and trends of bald eagle, forest raptor and passerine (2-4 years), osprey (2-3 years), peregrine falcon, coastal marsh nesting and foraging bird (2-4 years), and freshwater wetland bird (2-4 years) populations.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Monitor contaminant levels that may impact raptor populations.
- Routinely monitor the population trends of vernal pool wildlife.
- Monitor population trends, breeding success, and habitat of reptiles near the edge of their range.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project, focusing on special concern reptiles, eastern tiger salamanders, Cope's gray treefrogs, and vernal pool obligate and facultative species, species that depend wholly or significantly on vernal pools for breeding.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

4. Delaware Bay Shoreline

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring success*

a. Habitats

The Delaware Bay Shoreline extends from Cape May Canal to Oyster Cove at the western corner of Cumberland County (Figure 15). The shoreline has critical beach, dune, and tidal and freshwater wetland habitats for migratory birds and other wildlife of the Coastal Plain.

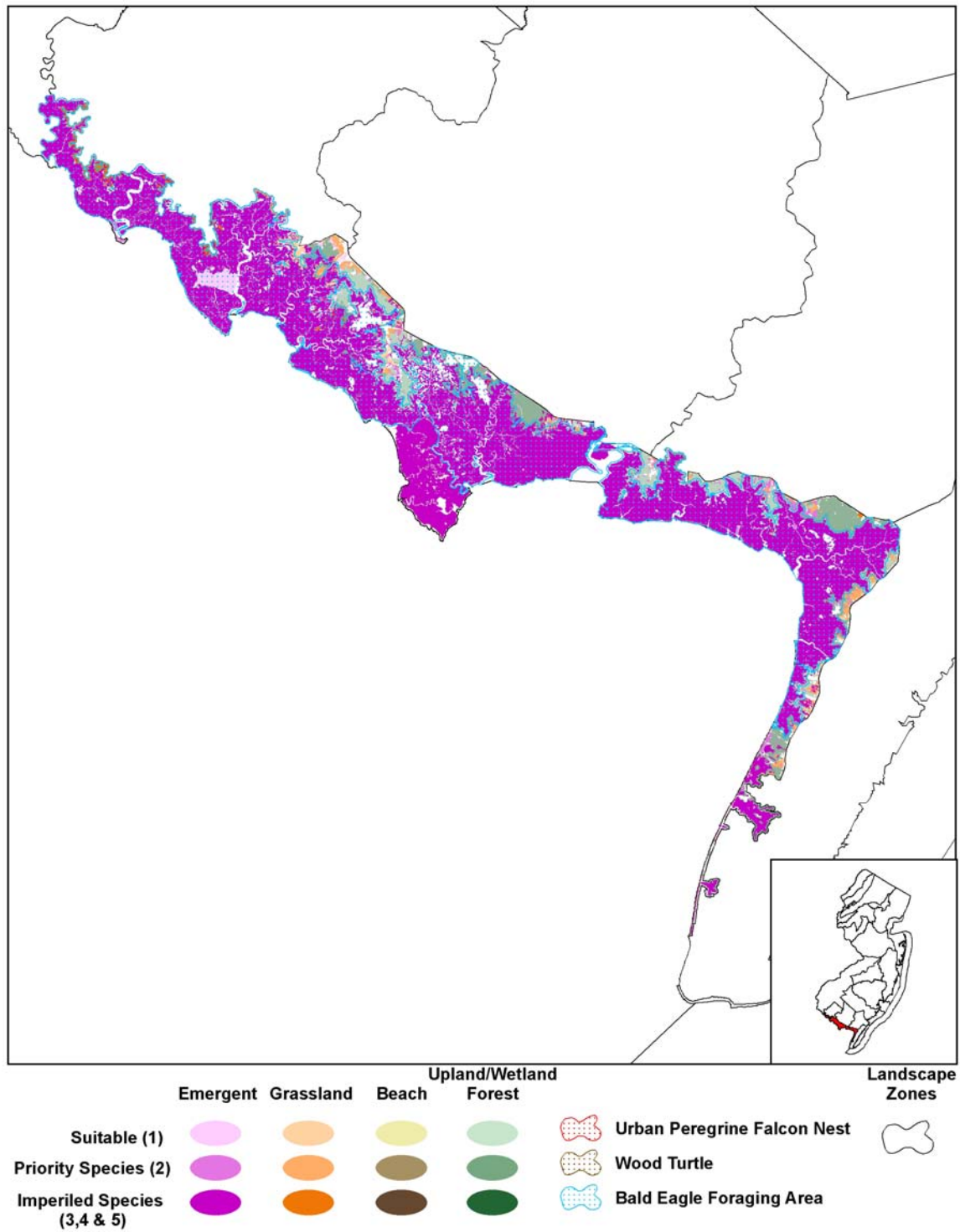
Priority areas along the Delaware Bay Shoreline include (from east to west) Cape May NWR-Delaware Bay Division, Dennis Creek WMA, Dennis Township PSE&G, Heislerville WMA, Maurice River and Commercial townships PSE&G, Egg Island WMA, Fortescue WMA, The Glades natural area, Nantuxent WMA, New Sweden WMA, Dix WMA, and Bayside WMA. Approximately 4,800 hectares (18.5 sq. mi.) of marsh have been restored since 1996 under the PSE&G estuary enhancement program, which converted artificial impoundments of salt hay farms (flooded once or twice a month) to daily-flooded tidal saltmarsh.

b. Wildlife of Greatest Conservation Need

There are seven federal threatened (the sole terrestrial species species: bald eagle), five state endangered, four state threatened, and 23 special concern wildlife species in the Delaware Bay Shoreline zone. The black skimmer, northern harrier, peregrine falcon and sedge wren are among the state endangered wildlife. The black rail, black- and yellow-crowned night herons, osprey, and red knot are the state threatened species. Special concern wildlife include coastal marsh birds, colonial waterbirds, freshwater wetland birds, migratory raptors, migratory shorebirds, and the northern diamondback terrapin.

The Delaware Bay Shoreline is a critical migratory stopover for Western Hemispheric populations of migratory shorebirds, including red knot, ruddy turnstone, sanderling and semipalmated sandpiper. These migrants depend on the eggs of spawning horseshoe crabs for a major portion of their diets (50 to 90 percent) each spring before migrating from the Delaware Bay beaches to Arctic nesting grounds. The beaches also occasionally support small numbers of beach-nesting birds (such as piping plovers), but these species are primarily found in the Coastal Landscape Region. Coastal marshes and freshwater wetlands are habitat for bald eagles, ospreys, peregrine falcons, the state's black rail population, and northern diamondback terrapins. The Delaware Bay region is a critical migration and wintering area for American black ducks in the Atlantic Flyway. The coastal marsh edge is a habitat line followed by many fall-migrating birds that avoid the open water Delaware Bay crossing and seek a shorter crossing up-bay, a decision that might aid in their survival. Tables DB29 – DB35 identify the species of greatest conservation need within this zone.

1 **Figure 15.** Critical landscape habitats within the Delaware Bay Shoreline conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Delaware Bay Shoreline

Table DB29. Federal Endangered Species*

Common Name	Water	Beach	Wetlands
Birds			
Bald eagle			X
Reptiles			
Green sea turtle	X		
Leatherback sea turtle	X		
Loggerhead sea turtle	X		
Hawksbill sea turtle	X		
Kemp's ridley sea turtle	X		
Fish			
Shortnose Sturgeon	X		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

X: Species occurs within the identified habitat.

Table DB30. State Endangered Species

Common Name	Water	Beach	Wetlands
Birds			
Black skimmer		X	X
Least tern		X	
Northern harrier			X
Peregrine falcon			X
Sedge wren			X
Short-eared owl			X
Black skimmer		X	X

X: Species occurs within the identified habitat.

Table DB31. State Threatened Species

Common Name	Water	Beach	Wetlands
Birds			
Black rail			X
Black-crowned night heron			X
Osprey			X
Red knot		X	X
Yellow-crowned night heron			X

X: Species occurs within the identified habitat.

Table DB32. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands
Mammals			
Marsh rat			X
Birds			
American oystercatcher			X
Common barn owl			
Common tern			X
Forster's tern			X
Glossy ibis			X
Great blue heron			X
Great egret		X	X
Green heron			X
King rail			X
Least bittern			X
Least tern		X	X
Little blue heron			X
Marsh wren			X
Ruddy turnstone		X	X
Saltmarsh sharp-tailed sparrow			X
Sanderling		X	X
Seaside sparrow			X
Semipalmated sandpiper		X	X
Sharp-shinned hawk			X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Beach	Wetlands
Birds (continued)			
Snowy egret			X
Willet		X	X
Reptiles			
Northern diamondback terrapin		X	X
Insects			
A geometrid moth, <i>Eusarca fundaria</i>			X
A noctuid moth, <i>Meropleon titan</i>			X
Fish			
Atlantic sturgeon	X		

X: Species occurs within the identified habitat.

Table DB33. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands
Birds			
American black duck	X		X
American woodcock			X
Black scoter	X		X
Bufflehead	X		X
Canada Goose (Atlantic population)	X		X
Canvasback	X		X
Clapper rail			X
Greater scaup	X		X
Lesser scaup	X		X
Long-tailed duck	X		X
Northern bobwhite			X
Northern pintail			X
Surf scoter	X		X
Virginia rail			X
White-winged scoter	X		X
Wood duck			X

X: Species occurs within the identified habitat.

Table DB34. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table DB35. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beach	Wetlands
Mammals			
River otter	X		
Birds			
Sora rail			X

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Delaware Bay Shoreline

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Migratory shorebirds on the Delaware Bay beaches are threatened by limited food availability. The high harvest of horseshoe crabs since 1991 has reduced the crab population and has led to declines in migratory shorebirds including red knots, sanderlings, semipalmated sandpipers, ruddy turnstones and other shorebirds. Human disturbance associated with recreation is a serious threat to migratory shorebirds. A significant threat to habitats here is risk of oil and hazardous materials spills: Delaware Bay is the second largest port for oil transport on the East coast, so oil spills (such as the *Athos I* in 2004) are a real threat to habitats and animal populations. Predation seems to be the limiting factor preventing colonial waterbirds and most beach-nesting birds from nesting on the Delaware Bayshore; their current habitat use is primarily for foraging and post-nesting roosting. Erosion of the shoreline has been an ongoing concern, potentially affecting their suitability and use by spawning horseshoe crabs. This effect has been difficult to measure in the face of a serious decline in the crab population. Shoreline loss due to bulkheads and jetties is a concern, but some beach area has been gained in recent years with restoration of beaches at Moore's and Thompson's beaches. Similarly, tidal marshes have been restored in the PSE&G estuary enhancement program that converted large areas of salt hay farms to tidal saltmarsh. Environmental impacts of aquaculture are largely unmeasured and poorly understood. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, maintain, and enhance critical habitats and resources for migratory shorebirds (including red knot), black rail, northern harrier, osprey, bald eagle, and peregrine falcon populations; migratory songbirds, coastal marsh birds, waterfowl, and colonial waterbird communities.
- Inventory, determine distribution, and monitor migratory shorebirds in beach and marsh habitats, and black rails, northern harriers, bald eagles, ospreys, peregrine falcons, foraging marsh birds, and northern diamondback terrapins.
- Prevent, stabilize, and reverse declines of migratory shorebirds and resident coastal marsh birds such as black rails and northern harriers.
- Prevent, stabilize and reverse declines of endangered, threatened, and special concern fish species.
- Maintain bald eagle, osprey, and peregrine falcon populations.
- Restore the horseshoe crab population to above 1990-1991 levels.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife
- Promote public education and awareness and wildlife conservation.

1 e. Conservation Actions

Priority	Conservation Actions
Protect critical habitats for migratory shorebirds, other coastal marsh wildlife	
1°	Identify critical beach habitats and assess their condition for migratory shorebirds. Identify protection strategies and best management practices to maintain suitable habitat for migratory shorebirds in perpetuity. Maintain critical habitat identifications in Biotics database. (<i>Conserve wildlife – rare wildlife, Protect habitat – Landscape Project, Protect habitat – migratory birds</i>)
1°	Act to protect, enhance and restore habitat, as appropriate. Control and reduce disturbance to red knots and migratory shorebirds by closing posted areas during peak migration periods. Develop strategies to maximize food availability and beach suitability for migratory shorebirds by working with regulatory agencies to restore horseshoe crabs populations, minimize beach loss/development, and investigate beach enhancement. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds, Landscape Project</i>)
1°	Develop and implement best management practices for preservation of shoreline habitats. (<i>Protect habitat – migratory birds</i>)
1°	Manage forest and field habitats along the upland edge of the shoreline and marshes for raptor and passerine suitability, especially to maintain feeding and roosting habitat for autumn-migrating birds. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Protect habitats through innovative public and private partnerships. Promote landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant migratory shorebird, bald eagle, migratory songbird and tidal marsh bird populations. (<i>Protect habitat – migratory birds</i>)
1°	Develop and implement proactive habitat management/conservation plans for shorebirds, coastal marsh birds, migratory songbirds, colonial waterbirds, and waterfowl (consistent with the U.S. Shorebird Conservation Plan and the North American Waterbird Conservation Plan). (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Identify and implement best management practices for bald eagle, osprey, peregrine falcon, and rail populations. (<i>Conserve wildlife – rare wildlife</i>)
1°	Investigate impacts of aquaculture on migratory shorebirds, waterfowl and other wildlife of conservation concern. (<i>Conserve wildlife – rare wildlife; Aquaculture – land management</i>)
1°	Investigate the utility of a conservation zone to protect sensitive species and habitats in the bayshore area. (<i>Protect habitat – humans</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, land acquisition priorities, and development of management strategies for permanently protected lands. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds; Corridors – migratory birds</i>)

Priority	Conservation Actions (continued)
1°	Reduce human disturbance to red knots and other shorebirds. Notify wildlife law enforcement agents (and when applicable, conservation organizations and local municipalities) of critical staging areas; identify and enforce the necessary restrictions to human activities. (<i>Protect wildlife - humans</i>)
1°	Develop more stringent regulations governing off-road vehicles, and focus law enforcement efforts to protect critical habitats and conservation lands from illegal off-road vehicle use. (<i>Protect wildlife – humans; Protect habitat – recreational vehicles</i>)
1°	Enforce regulations governing recreation (including personal watercraft) in refuges and other sensitive habitats, and discourage activities that cause harm or disturbance to vegetation, wetlands and wildlife. (<i>Protect habitat – recreational vehicles</i>)
2°	Develop management guidelines for private landowners with significant bald eagle, northern harrier and rail habitats.
2°	Promote foraging, nesting and roosting of black skimmer and least tern where they are not ultimately limited by development and predators. (<i>Conserve wildlife – rare wildlife</i>)
Inventory and monitor migratory shorebirds and other coastal marsh wildlife	
1°	Survey suitable habitats to determine distribution of wildlife of greatest conservation need and establish baseline information for monitoring. Maintain shoreline surveys and develop marsh surveys for migratory shorebirds. Identify and record important migratory shorebird foraging and roosting areas. Conduct northern harrier and black rail surveys every two to four years. Develop baseline surveys for listed and SC rail species, and migratory songbird use. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds; Monitor wildlife – long-term monitoring</i>)
1°	Monitor red knot movements to identify patterns of habitat use in relation to horseshoe crab densities. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and degradation, disturbance, predation, contaminants, food supply availability, invasive plants, and competition with gull species. (<i>Conserve wildlife – invasives, cats, subsidized predators, contaminants; Protect habitat – sprawl, recreational vehicles, humans</i>)
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Determine carrying capacity of area marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)

1

Priority	Conservation Actions (continued)
1°	Identify critical habitats and assess their condition for migrating and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Act to maintain, enhance, and restore habitats for waterfowl, seeking management that complements listed and rare species management. (<i>Conserve wildlife – game species</i>)
Stabilize and reverse declines of coastal marsh wildlife (e.g., black rail, northern harrier)	
1°	Assess changes in availability of low and high marsh, directly and using indicator species (rails and northern harriers), and relate habitat changes to marsh management practices. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement BMPs for coastal marsh birds, especially northern harrier and black rail, particularly with regard to mosquito control and vegetation management in marshes. Investigate and promote actions that will restore marshes to pre-grid-ditched hydrology. (<i>Conserve wildlife – rare wildlife</i>)
1°	Assess population levels of listed and SC rails, and determine whether directed management efforts are needed to reach or maintain viable population levels. (<i>Conserve wildlife – rare wildlife</i>)
1°	Close the harvest season for northern diamondback terrapin and transfer to jurisdiction of ENSP. Maintain enforcement of Turtle Excluder Devices in crab traps set in bayshore waterways. (<i>Conserve wildlife – rare wildlife</i>)
2°	Research the population size, recruitment, habitat requirements and threats to the northern diamondback terrapin population. (<i>Conserve wildlife – rare wildlife</i>)
2°	Identify key road-crossing areas of northern diamondback terrapin and work with local or state transportation agencies to install turtle barriers. (<i>Conserve wildlife – rare wildlife</i>)
2°	Identify migratory pathways of bats in the shoreline zone and evaluate possible population impacts of development such as wind turbines. (<i>Protect habitat – humans</i>)
Stabilize and reverse declines of rare fish species	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish; Monitor wildlife – fish</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database. (<i>Status – fish; Monitor wildlife – fish</i>)
1°	Develop a fish Index of Biotic Integrity (IBI) to better assess, restore and protect NJ's non-trout streams in the Lower Delaware River drainage. (<i>Native wildlife – fish; Status – fish; Monitor wildlife – fish</i>)

1

Priority	Conservation Actions (continued)
1°	Seek Category One antidegradation classifications in water bodies where listed or special concern species occur, or where there are high levels of biological integrity based on fish assemblage. Seek other appropriate classifications for stream segments based on IBI results. (<i>Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife - fish</i>)
Maintain bald eagle, osprey, and peregrine falcon populations	
1°	Develop and recommend BMPs for bald eagle foraging habitat as well as osprey and peregrine falcon nesting areas on the bayshore, with regard to disturbance, mosquito control and vegetation management in marshes. (<i>Conserve wildlife – rare wildlife</i>)
Restore horseshoe crab population to above 1990-1991 level	
1°	Create additional oversight for the conservation of horseshoe crabs in Delaware Bay and the mid-Atlantic region. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Monitor population and egg densities relative to migratory shorebird needs, and recommend management to increase horseshoe crab populations in the short term (e.g., harvest restrictions) and long term (e.g., habitat enhancement and harvest moratorium). (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
1°	Develop BMPs for shoreline management to maintain and enhance horseshoe crab populations. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Protect and restore marshes from phragmites (common reed) invasion. (<i>Conserve wildlife – invasives</i>)
1°	Minimize impacts of mute swans in coastal salt marshes as well as impoundments managed for shorebirds and waterfowl. (<i>Conserve wildlife – invasives</i>)
1°	Investigate the impact of laughing gulls on habitat use by migratory shorebirds. (<i>Protect habitat – migratory birds</i>)
Promote public education and awareness and wildlife conservation	
1°	Maintain and enhance ecotourism on Delaware Bayshore in a manner consistent with wildlife and habitat enhancement. (<i>Education – humans</i>)
1°	Educate the public about the importance of habitat to populations of migratory birds, and the importance of maintaining disturbance-free areas for them. (<i>Education – humans</i>)
1°	Develop and maintain educational materials and viewing opportunities for the public. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)

2
3

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect bald eagle, osprey, peregrine falcon, high-marsh nesting birds, and coastal marsh-edge nesting areas.
 - Work with landowners to maintain/enhance existing habitats where listed special concern fish species occur.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, Natural Lands Trust, The Nature Conservancy-NJ Chapter, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations (e.g., shorebird surveys in spring and fall and northern diamondback terrapin nesting).
 - Involve Citizen Scientists in management projects and protection projects, such as protecting migratory shorebird feeding areas, shorebird banding and sightings, and building osprey nest structures.
- Promote backyard habitat management for migratory raptors.
- Collaborate with NJ Audubon Society to educate public on the negative effects of feral cats on wildlife species of conservation concern, and the problems unleashed dogs cause migratory shorebirds.

Conservation Organizations

- Partner with watershed groups (such as Delaware Riverkeeper) and conservation organizations such as NJ Audubon Society (NJAS), The Nature Conservancy (TNC) and Natural Lands Trust to protect and enhance habitats for rare species.
 - Protect bald eagle, osprey, peregrine falcon, and coastal marsh bird nesting and foraging sites.
- Consult with conservation organizations to develop educational programs and wildlife festivals.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres and local land trusts.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA-NRCS, USFWS, and the DCA, Office of Smart Growth to protect and enhance habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to maintain and protect habitats for bald eagle, colonial waterbird, osprey, peregrine falcon, and coastal marsh bird nesting and foraging.
 - DFW to develop a plan with wildlife law enforcement agents to protect all of the important habitats for spring-migrating shorebirds from disturbance.
 - DFW to work with wildlife law enforcement and municipalities to develop a plan to limit public access and disturbance to marsh bird nesting sites, and to maintain

- 1 enforcement of regulations protecting northern diamondback terrapins from crab
- 2 traps.
- 3 ○ DFW and USFWS to work together at Cape May NWR and WMAs to enhance
- 4 refuge habitat for forest interior nesters and migratory landbirds.
- 5 ○ DFW will lead the investigation of establishing marine conservation zone(s).
- 6 ○ DFW will work with individual municipalities, DPF, the US Fish and Wildlife
- 7 Service, and other landowning entities to target predators and reduce their effects on
- 8 ground-nesting bird colonies near Cape May.
- 9 ○ DFW and conservation organizations will work with the DEP's Land Use Regulation
- 10 Program (LURP) to protect and appropriately classify wetlands for spotted turtle,
- 11 carpenter frog, Fowler's toad, and marbled salamander populations.
- 12 ○ DFW will work with LURP to discourage permitting of bulkheads and other
- 13 "hardening" of the shoreline and to seek mitigation projects that will enhance
- 14 shoreline and salt marsh habitats for wildlife.
- 15 ○ Develop and implement best management practices for marsh habitats to enhance
- 16 habitat for migratory shorebirds, high and low marsh birds, and migratory raptors and
- 17 passerines on state lands and with natural resource managers, county and municipal
- 18 utility authorities and planners.
- 19 ○ DFW to work with the U.S. Fish and Wildlife Service and the U.S. Army Corps of
- 20 Engineers to ensure that beach fill and beach re-nourishment projects include
- 21 migratory shorebird-horseshoe crab habitat enhancement.
- 22 ○ DFW to work with the U.S. Fish and Wildlife Service and others to restore tidal
- 23 wetlands where appropriate for migratory shorebirds, marsh birds, raptors and
- 24 songbirds.
- 25 ○ DFW to work with state and county mosquito commissions to implement marsh
- 26 management that improves marshes for migratory shorebirds, rails and harriers,
- 27 allowing for moist-soils as well as native salt marsh vegetation.
- 28 ○ DFW and DEP's Bureau of Water Monitoring and Standards to work together to
- 29 recommend classification upgrades in water bodies where listed or special concern
- 30 species occur.
- 31 ○ DFW to partner with local, county and state authorities to establish best management
- 32 practices in areas where listed or special concern fish and wildlife species occur.
- 33 ○ DFW to work with the LURP to make recommendations on stream encroachment
- 34 permit issues for areas where listed or special concern species occur.
- 35 ○ DFW to work with USFWS and other state, federal, and non-governmental partners
- 36 to implement North American Waterfowl Management Plan as appropriate.
- 37 ○ DFW to work with USFWS and other state and federal partners to implement the
- 38 American Woodcock Management Plan as appropriate, seeking areas where such
- 39 management complements rare species management.
- 40 ○ DFW to work with federal and state agencies, including USFWS, USCG, National
- 41 Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and
- 42 NJ Office of Natural Resources Restoration (NRCS) to plan for and assist with
- 43 emergency oil spill response.
- 44 ○ DFW and DPF to work with the USFWS to develop effective plans to eradicate
- 45 invasive non-indigenous plants on federal and state lands that are threatening critical
- 46 wildlife habitats.

- DFW to determine groundwater recharge areas for Cope's gray treefrog breeding pools with the Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need, their habitats, the potential harmful effects of disturbance on beach-nesting and coastal marsh birds, and the importance of the Delaware Bay migratory stopover.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee Farmland Preservation, local land trusts, and through mitigation.
- Support the completion of land acquisition in the US Fish and Wildlife Service's Cape May National Wildlife Refuge acquisition boundary, and expansion of that boundary (per Cape May NWR Comprehensive Conservation Plan, 2004).
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at federal, state, and local levels.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time using aerial photography; monitor efficacy of habitat management and restoration efforts, and relate habitat changes to key indicator wildlife species.
- Annually monitor abundance, productivity, distribution, and trends of migratory shorebird, bald eagle, osprey (biannually), peregrine falcon, black rail and northern harrier (biannually or more), colonial waterbird, and coastal rail populations.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Monitor weight gains of red knot and migratory shorebird populations during the stopover period. Monitor horseshoe crab egg density in relation to regulatory and habitat conditions.
- Monitor nesting density and productivity of red knots at Arctic breeding grounds.
- Monitor population trends of red knots at wintering grounds in Bahia Lomas, Chile, and in Argentina.
- Monitor species abundance of migratory raptors at key locations to determine trends in migration counts. Sponsor "Hawk Watches" during the fall migration.
- Measure population changes of reptiles and amphibians through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project, focusing on special concern reptiles, Eastern tiger salamander, Cope's gray treefrog, and vernal pool obligate and facultative species, species that depend wholly or significantly on vernal pools for breeding.

5. Cape May Peninsula

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring success*

a. Habitats

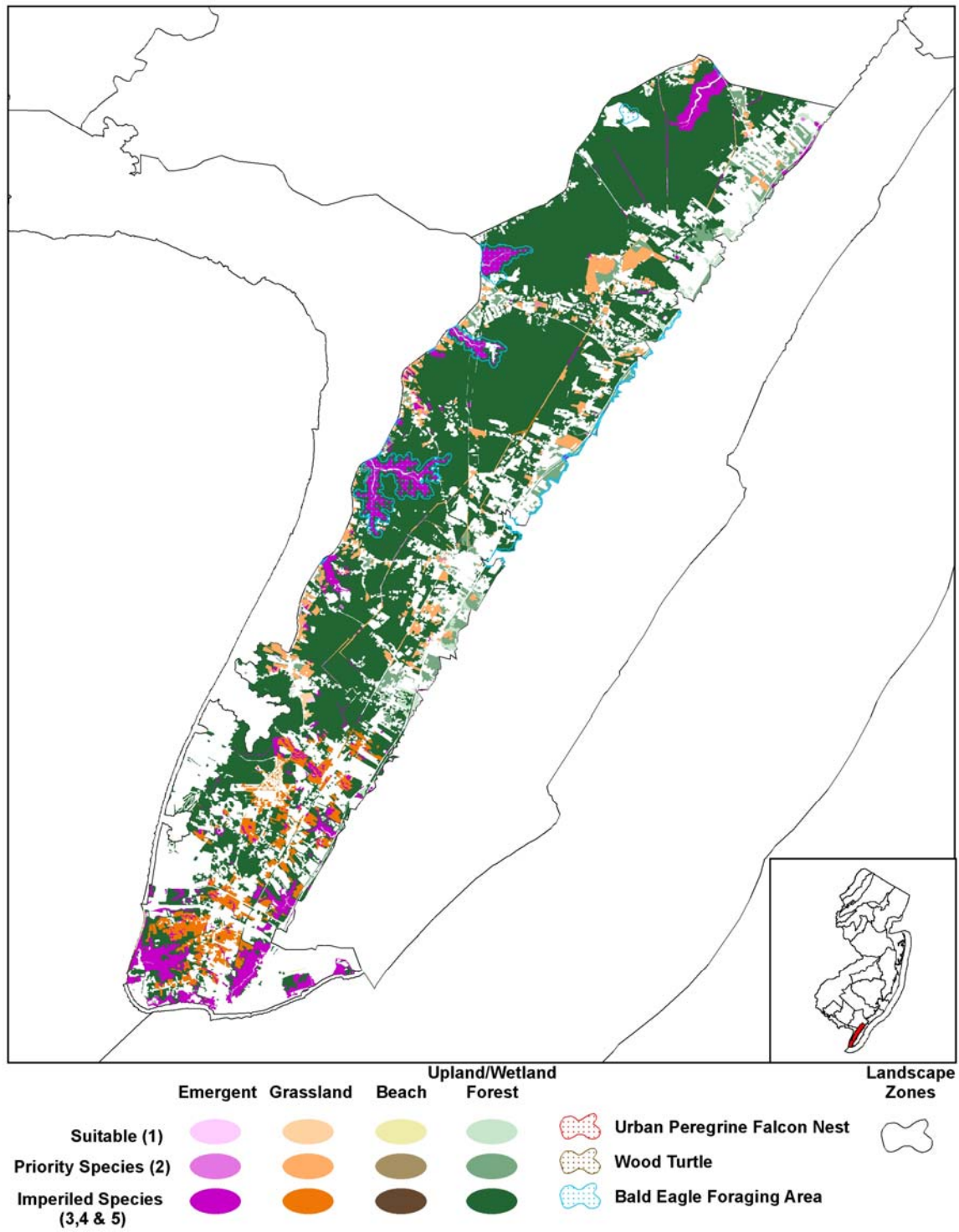
The Cape May Peninsula zone includes inland Cape May County (excluding the Coastal Landscape region to the east and the Delaware Bay shoreline to the west), spanning from the southern tip of Cape May to portions of Dennis and Upper townships to the north (Figure 16). Due to its geography, the peninsula's habitats comprise a nationally-important area of the Atlantic Flyway in the way migratory birds are funneled toward the Delaware Bay. It also holds populations of rare wildlife that are limited to this far southern reach of the state. Habitats range from the beaches of the Cape May Point area to native dune forests at Higbee Beach, mixed upland forest, and the wetland forest of Beaver Swamp and Cape May NWR. A corridor of upland and wetland forest persists in the center of the peninsula. Patches of fields persist on the peninsula adjacent to both forest and marsh.

Important conservation areas include Higbee Beach WMA, parts of Cape May Point State Park and Cape May Meadows Preserve, Beaver Swamp WMA, Cape May NWR-Great Cedar Swamp Division, and Lizard Tail Swamp preserve. Some lands are also held by the water supply authority in Middle Township, including part of the valuable Fishing Creek headwaters. The county park system includes the Fishing Creek freshwater marsh in Lower and Middle townships, and upland forests in Middle and Upper townships.

b. Wildlife of Greatest Conservation Need

The nationally-important migration of raptors, songbirds, and American woodcock through the peninsula represent some of the zone's most notable wildlife. In addition, species inhabiting the peninsula include the federal threatened bald eagle and the state endangered red-shouldered hawk, northern harrier, peregrine falcon, Cope's gray treefrog, and eastern tiger salamander. State threatened species include the barred owl, black-crowned night-heron, bobolink, Cooper's hawk, osprey, red knot, red-headed woodpecker, northern pine snake, Pine Barrens treefrog, and frosted elfin. Special concern wildlife include forest raptors and passerines, freshwater wetland birds, foraging coastal and freshwater marsh birds, grassland birds (primarily on the grounds of Cape May Airport), migratory shorebirds, eastern box turtle, eastern king snake, carpenter frog, Fowler's toad and marbled salamander. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, occur on the Cape May Peninsula. Maintaining the priority wildlife habitats, particularly those for migratory and forest birds, will adequately protect habitats for most of the rare wildlife populations; however, special attention is needed to maintain and recover the eastern tiger salamander and Cope's gray treefrog. Tables DB36 – DB42 identify the species of greatest conservation need within this zone.

1 **Figure 16.** Critical landscape habitats within the Cape May Peninsula conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Cape May Peninsula

Table DB36. Federal Endangered Species*

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
Bald eagle		X			X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

X: Species occurs within the identified habitat.

Table DB37. State Endangered Species

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
Loggerhead shrike				R	
Northern harrier			X	X	
Peregrine falcon			X		
Pied-billed grebe			X		
Red-shouldered hawk					X
Amphibians					
Cope's gray treefrog			X		X
Eastern tiger salamander			X		X

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

Table DB38. State Threatened Species

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
Barred owl					X
Black-crowned night heron			X		
Bobolink				X	
Cooper's hawk					X
Osprey			X		
Red knot		X			
Red-headed woodpecker					X
Yellow-crowned night heron			X		X
Reptiles					
Northern pine snake					X
Amphibians					
Pine Barrens treefrog					X
Insects					
Frosted elfin				X	X

X: Species occurs within the identified habitat.

Table DB39. Nongame Species of Conservation Concern

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals					
Eastern red bat					X*
Eastern small-footed myotis					X*
Hoary bat					X*
Silver-haired bat					X*
Eastern red bat					X*
Birds					
Acadian flycatcher					X
American kestrel				X	
American oystercatcher			X		
Baltimore oriole					X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)					
Blackburnian warbler					X
Black-and-white warbler					X
Black-billed cuckoo					X
Black-throated green					X
Blue-winged warbler					X
Broad-winged hawk					X
Brown thrasher					X
Cattle egret			X	X	
Chimney swift				X	
Chuck-will's-widow					X
Common barn owl				X	
Common tern			X		
Eastern kingbird				X	X
Eastern meadowlark				X	
Eastern screech-owl					X
Eastern towhee					X
Eastern wood-peewee					X
Field sparrow				X	
Forster's tern			X		
Glossy ibis			X		
Gray catbird				X	X
Great blue heron			X		
Great crested flycatcher					X
Great egret		X	X		
Green heron			X		
Hooded warbler					X
Horned lark			X		
Indigo bunting				X	
Kentucky warbler					X
King rail			X		
Least bittern			X		
Least tern		X	X		
Louisiana waterthrush					X
Marsh wren			X		
Northern flicker					X
Northern parula					X
Pine warbler					X
Prairie warbler					X
Prothonotary warbler					X
Saltmarsh sharp-tailed sparrow			X		
Scarlet tanager					X
Seaside sparrow			X		
Sharp-shinned hawk					X
Snowy egret			X		
Tricolored heron			X		
Whip-poor-will					X
Willow flycatcher					X
Wood thrush					X
Worm-eating warbler					X
Yellow-billed cuckoo					X
Yellow-breasted chat					X
Yellow-throated vireo					X
Yellow-throated warbler					X
Reptiles					
Eastern box turtle					X
Eastern king snake					X
Spotted turtle			X		
Amphibians					
Carpenter frog			X		X
Fowlers toad			X		X
Marbled salamander			X		X

Nongame Species of Conservation Concern (continued)

Insects					
A noctuid moth, <i>Cucullia alfarata</i>				X	
Maritime sunflower borer, <i>Papaipema maritima</i>			X	X	
Precious underwing, <i>Catocala pretiosa pretiosa</i>					X
Rare skipper, <i>Problema bulenta</i>					X
Fish					
Atlantic sturgeon	X				

*Potential presence.

X: Species occurs within the identified habitat.

Table DB40. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
American black duck	X		X		
American woodcock			X		X
Black scoter	X				
Bufflehead	X		X		
Canada Goose (Atlantic population)	X		X		
Clapper rail			X		
Long-tailed duck	X				
Northern bobwhite				X	X
Northern pintail	X		X		
Surf scoter	X				
Virginia rail			X		
White-winged scoter	X				
Wood duck			X		

X: Species occurs within the identified habitat.

Table DB41. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Hickory shad	X

X: Species occurs within the identified habitat.

Table DB42. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beach	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals					
River otter	X		X		
Birds					
Sora rail			X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Cape May Peninsula

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Wildlife and their associated habitats within Cape May Peninsula are under severe pressure from development: 40 percent of wildlife habitat was lost between 1975 and 1995 due to development as this area's resorts continue to grow rapidly. Additional losses occur due to fragmentation associated with development, degrading habitat for migratory raptors, forest passerines, and nearly all forest and field-dependent birds. Development also destroys and degrades wetland habitats, leading to water quality declines, the proliferation of deleterious invasive plants, and pressure on groundwater resources that impact eastern tiger salamander and Cope's gray treefrog populations. Encroachment from development and recreational activities negatively impact nesting and foraging bald eagles and ospreys. Cavity-nesters are threatened by loss of large trees and competition from invasive birds, while scrub-shrub birds are threatened by competition and loss of suitable habitats to intensive land uses. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, enhance, and restore forest and field habitats to provide feeding, resting and roosting resources for migratory raptors, passerines, American woodcock, and butterflies and moths.
- Protect and enhance critical habitats as identified by the Landscape Project for migratory shorebird populations; coastal marsh bird, colonial waterbird, forest passerine, freshwater wetland bird, and scrub-shrub bird communities; Cope's gray treefrog, eastern tiger salamander, and special concern amphibian populations.
- Inventory and monitor, and determine distribution and habitat requirements, of the autumn-migration birds, forest-dependent resident birds, and listed and special concern amphibians and reptiles of the peninsula.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Prevent and reverse declines of coastal marsh birds, colonial waterbirds, freshwater wetland birds, scrub-shrub birds, listed and special concern amphibians, and listed butterfly and moth species.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Develop habitat conservation goals that will meet the recovery needs of endangered and threatened wildlife populations that depend on forest, coastal and wetland habitats.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Identify and protect summer roosting habitat for Indiana bats and other forest-dwelling bat species.
- Promote public education and awareness of wildlife conservation.

1 e. Conservation Actions

Priority	Conservation Actions
Protect habitats for migratory birds	
1°	Continue to identify critical habitats for migratory birds, assess their condition, and maintain them in the Landscape Project and the Biotics database. Identify trends in habitat change and habitat requirements to maintain the migration at viable levels for species populations. Develop an action plan should habitat levels fall below the minimum necessary to sustain the migration. (<i>Protect habitat – migratory birds; Landscape Project</i>)
1°	Act to protect, enhance, and restore habitat to maintain the migration of raptor and passerine populations at viable levels. Actively manage state and other conservation lands to enhance autumn food availability, and to enhance contiguous forest for forest-interior nesters. Promote backyard habitat management to make similar improvements on private lands. Maintain and enhance floodplain forests on private and public lands for forest birds by promoting contiguous forests and discouraging fragmentation. (<i>Conserve wildlife – rare wildlife; Corridors – migratory birds; Protect habitat – migratory birds</i>)
1°	Identify best management practices for forest raptors and passerines (both resident and migrating), as well as scrub-shrub and field birds, and implement them on conservation lands in the peninsula. (<i>Conserve wildlife – rare wildlife; Corridors – migratory birds; Protect habitat – migratory birds</i>)
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, land acquisition priorities, and development of management strategies for permanently protected lands. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)
2°	Research survey methods used by other states, agencies, and organizations for maintaining important bird migration areas. (<i>Protect habitat – migratory birds</i>)
Protect critical habitat as identified by the Landscape Project	
1°	Act to protect, enhance, and restore habitat to maintain the migration of raptor and passerine populations at viable levels. Actively manage state and other conservation lands to enhance food availability during the autumn season, and to enhance contiguous forest for forest-interior nesters. Promote backyard habitat management to make similar improvements on private lands. Maintain and enhance floodplain forests on private and public lands for forest passerines by promoting contiguous forests and discouraging fragmentation. Protect freshwater wetland habitats on public and private lands. (<i>Protect habitat – Landscape Project, migratory birds; Corridors – migratory birds</i>)

1

Priority	Conservation Actions (continued)
1°	Develop and implement proactive habitat management/conservation plans for the landbird migration through the peninsula that also addresses forest interior bird nesting requirements. Develop and implement conservation plans for eastern tiger salamander, Cope's gray treefrog (consistent with the plan for Northeast Amphibian and Reptile Conservation), and freshwater wetland birds (consistent with the North American Waterbird Conservation Plan). (<i>Conserve wildlife – rare wildlife</i>)
1°	Protect habitats through innovative public and private partnerships. Promote landowner incentives for protecting and managing upland fields and forests and wetland forests for resident and migratory birds. Develop landowner cooperative agreements to protect significant freshwater wetland bird sites and vernal pools where they occur.
1°	Develop more stringent regulations governing off-road vehicles, and focus law enforcement efforts to protect critical habitats and conservation lands from illegal use of off-road vehicles. (<i>Conserve wildlife - recreational vehicles</i>)
1°	Enforce regulations governing recreation (including personal watercraft) in refuges and other sensitive habitats, and discourage activities that cause harm or disturbance to vegetation, wetlands and wildlife. (<i>Conserve wildlife - recreational vehicles; Protect habitat - humans; Protect wildlife - humans</i>)
2°	Identify and research water quality parameters for eastern tiger salamander, Cope's gray treefrog, and other vernal pool amphibian populations. Investigate the effects of mosquito control on amphibian, dragonfly, and damselfly populations.
2°	Develop management guidelines for private landowners with significant habitats for forest and migratory birds, as well as other listed species.
Inventory and monitor migratory and forest-dependent birds, rare reptiles and amphibians, and other forest-dependent rare wildlife species	
1°	Regularly survey suitable habitats to determine distribution and trend of migratory raptors and passerines and measure their habitat use patterns. Identify important migratory shorebird foraging and roosting areas. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Research the intensity and characteristics of threats to fall migrating birds and their habitats, including effects of habitat loss and degradation, disturbance, predation, and food supply availability.
1°	Regularly survey suitable habitats for E. tiger salamander and S. (Cope's) gray treefrog to monitor population size, trends, productivity, and suitability of habitats.
1°	Identify and protect bald eagle nesting and foraging areas with the cooperation of landowners, law enforcement and volunteers, and by closing posted areas to human access as necessary. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks), northern saw-whet owls, and Eastern screech-owls. (<i>Monitor wildlife – long-term monitoring</i>)

Priority	Conservation Actions (continued)
1°	Maintain surveys for American woodcocks; review available survey data in the peninsula, assess habitat use and habitat condition to determine species status and management needs. (<i>Conserve wildlife – game species</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
Monitor, maintain, and enhance populations of breeding, migrating and wintering waterfowl of conservation concern	
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Conserve wildlife – game species; Monitor wildlife – long-term monitoring</i>)
1°	Determine carrying capacity of area marshes for wintering black ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for migrating and wintering waterfowl populations of conservation concern. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl of conservation concern. (<i>Conserve wildlife – game species</i>)
Stabilize populations of colonial waterbirds, freshwater wetland birds, scrub-shrub birds and Lepidoteran (butterflies and moths) species	
1°	Develop and implement BMPs for marsh management (e.g., mosquito control, rights-of-way management) and freshwater wetland creation (e.g., mitigation wetlands). (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop BMPs for powerlines and other rights-of-way and implement for the conservation of rare butterflies and moths. (<i>Conserve wildlife – rare wildlife</i>)
1°	Determine optimal buffer size for wetlands, riparian and floodplain areas and make recommendations for their maintenance.
Stabilize and reverse declines of rare fish species	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish; Monitor wildlife - fish</i>)
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Protect habitat – fish</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database. (<i>Status – fish</i>)
1°	Maintain the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database to determine distributions of fishes identified as special concern by the Delphi process. (<i>Native wildlife – fish; Status – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Protect habitat – fish; Monitor wildlife - fish</i>)

1

Priority	Conservation Actions (continued)
Develop habitat conservation goals to meet recovery needs of forest wildlife	
1°	Determine the habitat needs to maintain both migratory and resident forest birds in the peninsula in a quantified way, and implement planning and management to maintain or reach those levels. (<i>Conserve wildlife – rare wildlife; Protect habitat – migratory birds</i>)
Develop habitat conservation goals to meet recovery needs of coastal and freshwater marsh wildlife	
1°	Monitor red knot movements to identify patterns of habitat use in relation to horseshoe crab densities and habitat variables. Identify minimum habitat standards to maintain migratory shorebird populations and implement within land acquisition and management plans. (<i>Corridors – migratory birds; Protect habitat – migratory birds</i>)
Develop habitat conservation goals to meet recovery needs of rare amphibians	
1°	Investigate terrestrial habitat requirements for Cope's gray treefrog and eastern tiger salamander. Investigate habitat requirements of meta-populations. (<i>Conserve wildlife – rare wildlife</i>)
1°	Protect habitats through innovative public and private partnerships. Promote landowner incentives for protecting and managing vernal pools, wetlands and uplands that support tiger salamander and gray treefrog sites and metapopulations.
1°	Identify the habitats and corridors necessary to maintain metapopulations linking known sites, and design wetland protection, land acquisition and management goals to maintain viable populations. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify and research water quality parameters for E. tiger salamander, Cope's gray treefrog, and other vernal pool amphibian populations. Investigate the effects of mosquito control on amphibian and Odonate populations. (<i>Conserve wildlife – rare wildlife; Protect aquatic wildlife - humans, development</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)
1°	Develop area-specific deer density or percent-reduction targets. As appropriate, continue to develop and expand incentives for harvesting antlerless deer.
1°	Survey and monitor for the spread of invasive insect species that jeopardize forest health. Species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control methods to reduce tree damage, limit the spread of infestations, with consideration of impacts to rare wildlife. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)

Priority	Conservation Actions (continued)
1°	Restore native wetland vegetation to Phragmites-dominated areas like Pond Creek. (<i>Restore aquatic habitat – development</i>)
1°	Identify areas through surveys and public participation where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical or biological control measures to eradicate invasive plants in areas identified as critical habitat for endangered, threatened or priority wildlife, and threatened by invasive non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Implement control of feral cats (as invasive species) to minimize this source of mortality on breeding and migrating songbirds. (<i>Conserve wildlife–cats, subsidized predators</i>)
Identify and protect habitat for Indiana bats and other forest dwelling bat species	
1°	Determine summer range, migratory pathways, and habitat use by Indiana bats and other forest dwelling bat species. Use data to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., providing landowner incentives for enhancing and protecting habitat, promoting education regarding importance of bat conservation). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
2°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999).
Promote public education and awareness and wildlife conservation	
1°	Maintain and enhance ecotourism on the Cape May Peninsula in a manner consistent with wildlife and habitat enhancement. (<i>Education – humans</i>)
1°	Educate public about the importance of habitat in migration areas. (<i>Education – humans; Protect habitat – migratory birds</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)
2°	Develop and maintain education materials and viewing opportunities for the public. (<i>Education – humans</i>)
2°	Encourage native plant use in landscaping through public awareness and landscaping companies, as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Protect habitat – migratory birds</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect and enhance forest and field habitats for migratory landbirds and forest nesting birds. Publish management guidelines for private landowners.
 - Utilize incentive programs that encourage the management of fields, scrub-shrub and forest patches.
 - Through incentive programs, target private landowners surrounding public natural lands to manage land for forests in order to increase effective size and connectivity of forest patches.
 - Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, The Nature Conservancy, Natural Lands Trust, and local municipalities for the conservation of fields, scrub-shrub and forest patches.
 - Work with landowners to maintain/enhance existing habitats where listed special concern fish species occur.
 - In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups (NJ Audubon Society, The Nature Conservancy-NJ Chapter, NJ Conservation Foundation) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations.
 - Involve Citizen Scientists in management projects, such as posting refuges to prevent disturbance.
- Promote backyard habitat management for migratory raptors and passerines, concentrating on the most southern 20 km (12.4 miles) of the peninsula.

Wildlife Professionals

- Identify conservation actions in other states with significant migration stopovers and corridors that might be applied to the Cape May Peninsula. Work on a mid-Atlantic and Atlantic Flyway regional basis for conservation of habitats.

Academic Institutions

- Partner with Rutgers and other academic institutions to conduct studies necessary to better understand the impacts of deer on biodiversity, forest health, and ecosystem processes and to develop habitat-specific or landscape-specific deer density targets.

Conservation Organizations

- Partner with watershed and conservation organizations such as NJ Audubon Society (NJAS) NJ Conservation Foundation (NJCF) and The Nature Conservancy (TNC) to protect and enhance habitats for rare species.

- Enhance habitat for eastern tiger salamander, Cope's gray treefrog, and forest birds in suitable areas (e.g., Lizard Tail Swamp).
- Work with conservation organizations such as NJ Audubon Society to develop educational programs and provide training in backyard habitat management.
- Work with organizations such as NJ Audubon Society to promote wildlife festivals in the region.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, NJCF, TNC, State Agricultural Development Committee Farmland Preservation, and local land trusts.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other conservation programs.
- Work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USDA-NRCS, USFWS, and the DCA, Office of Smart Growth to protect, enhance, and create habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection (DEP) Division of Fish and Wildlife (DFW) and USFWS to work together at Cape May NWR and WMAs to enhance refuge habitat for forest interior nesters and migratory landbirds.
 - DFW will work with the DEP's Land Use Regulation Program (LURP) and other DEP programs to protect habitats critical to the landbird migration and to adapt regulatory protection as necessary.
 - DFW and DPF to work with the DEP's Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant natural vegetative communities, particularly on public lands and lands that serve as wildlife corridors, to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
 - DFW and DPF to collaborate on forest management guidelines to achieve forest management goals for listed and rare wildlife, on both public and private lands.
 - DFW will lead law enforcement efforts to limit public access and disturbance to bald eagle nesting areas.
 - DFW will lead investigation of marine conservation zone planning as a tool to protect coastal marsh bird nesting and foraging areas.
 - DFW and conservation organizations to work with LURP to protect vernal pools and appropriately classify wetlands for listed and rare amphibians.
 - Expand efforts to create habitat and implement best management practices for forest-interior and migratory birds, and coastal marsh birds on Wildlife Management Areas and with natural resource managers, county and municipal utility authorities, and planners. Develop and implement BMPs for scrub-shrub birds in areas of existing fields on Higbee Beach and Dennis Creek WMAs.
 - DFW will create vernal pools on state lands where they may serve to increase existing habitat for eastern tiger salamander and Cope's gray treefrog.

- DFW to lead in the development of specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW to work with state and county mosquito commissions to measure the effects of, and prevent declines due to, the use of insecticides and biological controls at known amphibian breeding sites.
- DFW, and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with USFWS and other state, federal, and non-governmental partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan as appropriate, seeking areas where such management complements rare species management.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with federal and state agencies, including USFWS, USCG, National Oceanic and Atmospheric Administration, NJ Bureau of Emergency Response, and NJ Office of Natural Resources Restoration (NRCS), to plan for and assist with emergency oil spill response.
- DFW and DPF to work with the USFWS to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife, Japanese sedge and other invasive plants in critical wildlife habitats.
- DFW to determine groundwater recharge areas for Cope's gray treefrog and E. tiger salamander breeding pools with the Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water levels and quality, and conduct hydrological monitoring in these areas.
- DFW to lead in the development of educational materials for the public and private landowners about the Cape May fall migration, essential habitats, and the potential harmful effects of disturbance on nesting and resting birds.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs, wildlife viewing opportunities, and wildlife festivals.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee Farmland Preservation, local land trusts, and through mitigation.

- Support the completion of land acquisition in the US Fish and Wildlife Service's Cape May National Wildlife Refuge acquisition boundary, and expansion of that boundary (per Cape May NWR Comprehensive Conservation Plan, 2004).
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at federal, state, and local levels.

g. Monitoring Success

- Assess habitat quantity and monitor habitat changes over time; measure bird use of different habitats, including managed and unmanaged sites to monitor efficacy of habitat management and restoration efforts.
- Regularly monitor abundance, distribution, and trends of migrating landbirds, forest-interior birds (barred owls, red-shouldered hawks, Cooper's hawks), ospreys, tidal and freshwater marsh birds, colonial waterbirds, and migratory shorebirds. Monitor productivity of forest-nesting birds via an index to be developed.
- Regularly monitor the resident bald eagle population and habitat use.
- Monitor weight gains of red knot and migratory shorebird populations during the stopover period. Monitor red knot habitat use relative to habitat type and horseshoe crab egg density.
- Monitor nesting density and productivity of red knots at Arctic breeding grounds.
- Monitor population trends of red knots at wintering grounds in Bahia Lomas, Chile, and Argentina.
- Monitor species abundance of migratory raptors at key locations to determine trends in migration counts.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project, focusing on special concern reptiles, Eastern tiger salamander, Cope's gray treefrog, and vernal pool obligate and facultative species, species that depend wholly or significantly on vernal pools for breeding. Measure population fluctuations at both managed and unmanaged sites.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

Piedmont Plains Landscape

Contents of the Chapter on the Piedmont Plains Landscape

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- B. *Geology and Climate*
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- D. *Wildlife of Greatest Conservation Need*
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- F. *Conservation Zones, Assessments, and Strategies*
 - 1. *Northern Piedmont Plains*
 - a. *Habitats*
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 - 2. *Raritan Bay and North Atlantic*
 - 3. *Central Piedmont Plains*
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The Piedmont Plains landscape spans a diagonal zone across New Jersey from the southwest and the Delaware River estuary to the northeast at Sandy Hook and north to the Palisades. This expansive landscape runs across Salem, Gloucester, Camden, Burlington, Mercer, Monmouth, Middlesex, Somerset, Morris, Union, Essex, Hudson, and Bergen counties. The Delaware, the Raritan, and the Hudson are the prominent rivers and watershed regions in the Piedmont Plains.

A. Ecological Units in the Piedmont Plains

The U.S. Forest Service has developed a map of regional ecological units of the United States (Bailey, 1997) and the first iteration of a map that divides the eastern United States into subregional ecological units (Keys and others, 1995). The ecological units represent ecoregions that are distinct associations of interconnected physical and biological features. The eastern United States is divided into three regional levels – domains, divisions, and provinces – and two subregional levels – section and subsection.

According to Keys and others (1995), New Jersey is within the Humid Temperate Domain, and divided between the Hot Continental Division and the Subtropical Division. The Hot Continental Division includes the Eastern Broadleaf Forest Province and the Lower New England (221A), Hudson Valley (221B), and Northern Appalachian Piedmont (221C) Sections. The Subtropical Division in New Jersey includes the Outer Coastal Plain Mixed Forest Province and the Middle Atlantic Coastal Plain Section (232A).

U.S. Forest Service Ecological Units in the Piedmont Plains

The Piedmont Plains is within the Middle Atlantic Coastal Plain and the Northern Appalachian Piedmont Sections and contains the New Jersey Inner Coastal Plain (232Ac) and the Gettysburg Piedmont Lowland (221Da) and Newark (221Dc) subsections.

B. Geology and Climate

The Piedmont Plains landscape includes the Coastal Plain and Piedmont physiographic provinces of New Jersey. The New Jersey Inner Coastal Plain is within the Coastal Plain physiographic province and the subsection consists of terraced lowlands rising to crest-like hills and varies in elevation from sea level to 119 meters (390.4 feet). The Gettysburg Piedmont Lowland and Newark subsections are within the Piedmont physiographic province and are characterized by rolling hilly lowlands dissected by broad, winding river valleys with well-developed floodplains. Distinctly higher, rocky ridges and hills of basalt and diabase, such as the Palisades, disrupt the contours in the Piedmont Plains landscape. The average temperature varies from 10.5 to 12.2°C (51 to 54°F) and there are typically 165 to 225 days when the air temperature above 32°F (the growing season). The average annual precipitation is between 101.6 and 116.8 centimeters (40 and 46 inches).

C. Habitats and Conservation Zones of the Piedmont Plains Landscape

The Piedmont Plains Landscape received nearly half of all development that occurred in New Jersey during the period between 1984 and 1995 – approximately 45,000 hectares (177.6 sq. mi.). Cultivated/grasslands, wetland and upland forest, and estuarine emergent wetlands sustained the greatest losses.

Although extensive loss and fragmentation of grassland and forest habitats has increased the prevalence of smaller habitat patches, the Piedmont Plains Landscape (Figure 17) still has extensive grasslands and agricultural areas (115,537 hectares, 446 sq. mi.), fragmented deciduous and mixed deciduous-coniferous woodlands of pine-oak, mixed-oak, oak-hickory, and hardwood swamps (107,848 hectares or 416.4 sq. mi. of forest, 74,866 hectares or 289 sq. mi. of forested wetlands), tidal freshwater and brackish marshes (40,954 hectares or 158.1 sq. mi. of wetlands), and extensive riparian areas through the entire landscape. It is important to note that habitats identified as “grassland” within the Landscape Map and throughout this document include agricultural lands and therefore, are not necessarily suitable habitats for grassland species. Similarly, scrub/shrub habitat is included in the “forest” and “forested wetlands” habitats on the Landscape Maps.

The Delaware, Raritan, and Hudson are the prominent rivers and watershed regions in the Piedmont Plains. The tidal tributaries and wetlands of the Delaware River are characterized by a brackish estuary, from the Cohansey River to Camden, and freshwater tidal wetlands, from Camden north to Trenton.

Eight of the 10 most populated cities and municipalities in New Jersey are located in the Piedmont Plains Landscape, including Newark, Jersey City, Elizabeth, Edison Township, Woodbridge Township, Hamilton Township, Trenton, and Camden (Table PP1).

Table PP1. The most populated cities in New Jersey according to the 2000 Census.

Most Populous Cities	Population (2000 Census)	Landscape Region
Newark	273,546	Piedmont Plains
Jersey City	240,055	Piedmont Plains
Paterson	149,222	Piedmont Plains
Elizabeth	120,568	Piedmont Plains

Table PP1 (continued)

Most Populous Cities	Population (2000 Census)	Landscape Region
Edison Township	97,687	Piedmont Plains
Woodbridge Township	97,203	Piedmont Plains
Dover Township	89,706	Pinelands
Hamilton Township	87,109	Piedmont Plains
Trenton	85,403	Piedmont Plains
Camden	79,904	Piedmont Plains

This highly urbanized and developed region also serves as the transportation corridor between Pennsylvania and New York.

Most critical wildlife habitats are widely dispersed between the Delaware River estuary, the grasslands of the inner coastal plain, rolling hills of the piedmont, the beaches and dunes of Sandy Hook, and the cliffs of the Palisades.

The Priority Conservation Zones in the Piedmont Plains Landscape are:

- (1) Northern Piedmont Plains
- (2) Raritan Bay and North Atlantic Coast
- (3) Central Piedmont Plains
- (4) Southern Piedmont Plains

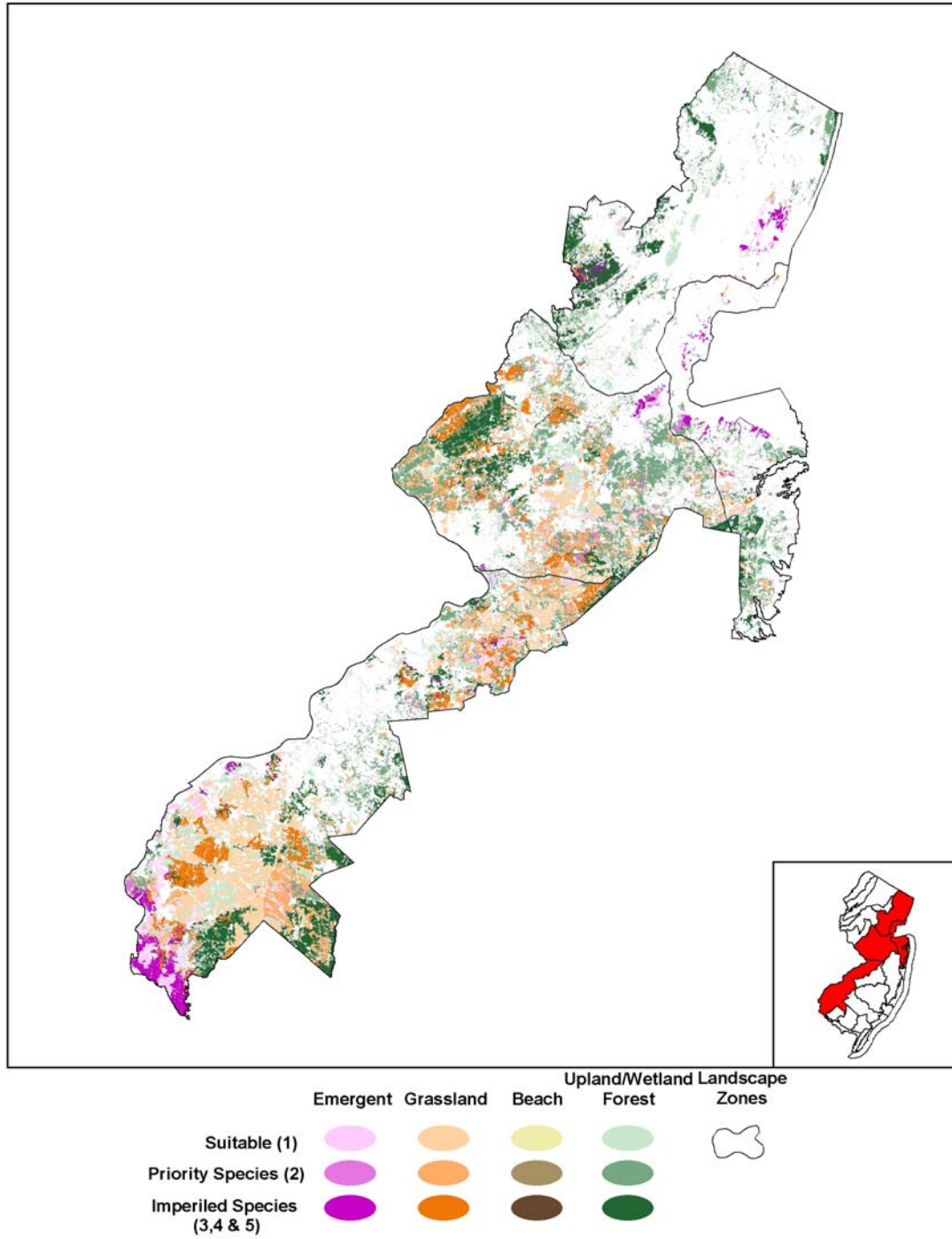
D. Wildlife of Greatest Conservation Need of the Piedmont Plains Landscape

Successful management of the Piedmont Plains Landscape is essential to conservation of several species including bald eagles, colonial waterbirds and freshwater wetland birds that inhabit riparian forests, brackish and freshwater wetlands. Robust grassland bird communities exist in the Southern Piedmont Zone. The eastern pondmussel and triangle floater inhabit the network of rivers found throughout this landscape. The Palisades Interstate Park is the last stronghold of the Allegheny woodrat in New Jersey, and the Northern Piedmont and the Raritan Bay and North Atlantic Coast are important for recovering populations of peregrine falcon and osprey.

Invasive, non-indigenous species often cause substantial ecological and economic problems. They frequently have competitive advantages because of the absence of predators, diseases and competitors that they typically evolve within other ecosystems or because of more efficient mechanisms of reproduction, dispersal or use of resources. They occur in every broad habitat type that occurs in the state. Invasive, non-indigenous plants threaten species diversity, composition and structure of our fields, forests, wetlands and aquatic habitats. Invasive, non-indigenous invertebrates such as zebra mussels and Asiatic (or Asian) clams have the potential to adversely impact aquatic habitats and species. Plants like Eurasian water-milfoil and vertebrates such as the northern snakehead threaten our aquatic resources and habitats. Emerald ash borer and Asian longhorn beetles have the potential to cause severe damage to our forests and wildlife habitat. Diseases such as West Nile virus have already had an impact on certain avian species.

Although heavily suburbanized, the Central and South Piedmont Plains has significant habitat for bog and wood turtles whose remnant populations are supported in fragmented grassland and

1 **Figure 17.** Critical landscape habitats within the Piedmont Plains Landscape and associated
 2 conservation zones as identified through the Landscape Map (v2).



woodland. Large forest tracts are important for breeding forest passerines and raptors and remnant populations of bobcat. The patchwork of habitats in this Landscape (forests, grasslands, wetlands, riparian areas) provide critical stopover sites for migratory birds to rest and refuel. The region's forests and riparian areas are also known to host populations of forest-dwelling bats and contain habitat suitable for summer colonies of Indiana bats.

Judicious management of the Piedmont Plains Landscape is essential to conserve some of the most significant natural areas in New Jersey: the Palisades, Great Swamp National Wildlife Refuge, the Meadowlands, Preakness Mountain, and Sourland Mountain. These areas support unique and intact ecosystems that are in jeopardy from surrounding land uses and other human impacts.

Finally, the Piedmont Plains Landscape is a critical transition area between the northern deciduous forest ecosystem of the Skylands Landscape and the southern coastal plain ecosystem of the Pinelands Landscape. Retaining and enhancing connectivity between these two landscapes is an important goal in the Piedmont Plains.

The Piedmont Plains supports three federal endangered or threatened species and potentially three other federally listed species, 21 state endangered species, 22 state threatened species, and 123 special concern and regional priority wildlife species. Federally listed species include the bald eagle, bog turtle, and dwarf wedgemussel and state endangered species include the Allegheny woodrat, bobcat, American bittern, peregrine falcon, and eastern tiger salamander. In addition, the American burying beetle, shortnose sturgeon, and summer populations of the federal endangered Indiana bat are suspected to be located within the Piedmont Plains region. Among the state threatened species are the barred owl, red-headed woodpecker, savannah sparrow, Pine Barrens treefrog, and silver-bordered fritillary.

The following tables list the wildlife of greatest conservation need, the suites of wildlife, and the conservation opportunity areas to conserve them in the Piedmont Plains. The wildlife species are prioritized by federal endangered and threatened, state endangered, state threatened, and special concern/regional priority status.

Prioritized List of the Wildlife of Greatest Conservation Need and their Location in the Piedmont Plains Landscape

Table PP2. Federal Endangered and Threatened Species

Common Name	Federal Status & Regional Priority	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Mammals					
Indiana bat	E	R**	R**	R**	R**
Birds					
Bald eagle	T		I		I
Reptiles					
Bog turtle	T	I	I	I	I
Mollusks					
Dwarf Wedgemussel	E & RP			I	I
Insects					
American burying beetle ♦	E	R	R		
Fish					
Shortnose sturgeon	E & RP			I	I

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦ Only historic records exist. Species believed to be extirpated.

T: Federally threatened species.

E: Federally endangered species.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table PP3. State Endangered Species

Common Name	Regional Priority	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Mammals					
Allegheny woodrat		I			
Bobcat		I		I	I
Birds					
American bittern	RP	I		I	I
Black skimmer	RP	I	R		
Henslow's Sparrow	RP	R	R		R
Least tern	RP	I	I		
Loggerhead shrike (migrant)	RP	I			
Northern goshawk		I			
Northern harrier		I	I	I	I
Peregrine falcon		I	I	I	I
Pied-billed grebe	RP	I	I	I	I
Red-shouldered hawk		I	I	I	I
Sedge wren	RP	I			I
Short-eared owl	RP				I
Upland sandpiper	RP		I	I	I
Vesper sparrow				I	I
Reptiles					
Timber rattlesnake				I	I
Queen snake					R
Amphibians					
Blue-spotted salamander		I		R	R
Eastern tiger salamander					I
Insects					
Appalachian grizzled skipper		R			
Bronze copper		R			I

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table PP4. State Threatened Species

Common Name	Regional Priority	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Birds					
Barred owl		I	I	I	I
Black-crowned night-heron	RP	I	I	I	I
Bobolink	RP	I		I	I
Cooper's hawk	RP	I	I	I	I
Grasshopper sparrow	RP	I	I	I	I
Long-eared owl		I		I	I
Osprey		I	I	I	I
Red-headed woodpecker	RP	I		I	I
Savannah sparrow		I	I	I	I
Yellow-crowned night-heron	RP	I	I		
Reptiles					
Northern pine snake			I		I
Wood turtle		I	I	I	I
Amphibians					
Eastern mud salamander				R	R
Long-tailed salamander		R		R	
Pine Barrens treefrog			I	I	I
Mollusks					
Eastern pondmussel					I
Tidewater mucket				R	R
Triangle floater				I	I
Yellow lampmussel				M	M
Insects					
Checkered white		R	I		
Frosted elfin				I	R
Silver-bordered fritillary				I	

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table PP5. Nongame Species of Conservation Concern

Common Name	Conservation Status	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Mammals					
Eastern small-footed myotis	RP	R**	R**	R**	R**
Eastern red bat	RP	R**	R**	R**	R**
Hoary bat	RP	R**	R**	R**	R**
Marsh rice rat	S3, G5	R	R	R	R
Silver-haired bat	RP	R**	R**	R**	R**
Southern bog lemming	RP	R	R	R	R
Birds					
Acadian flycatcher	RP	I	M	M	M
American golden-plover	RP	M		M	M
American kestrel	SC	I	I	I	I
American oystercatcher	RP		I		
Baltimore oriole	RP	I	I	I	I
Black-and-white warbler	RP	I	I	I	I
Black-billed cuckoo	RP	I	I	I	I
Blackburnian warbler	RP	I			
Black-throated blue warbler	RP	M		M	
Black-throated green warbler	SC	I	I	I	
Blue-headed vireo	SC	I	I		
Blue-winged warbler	RP	M	I	I	I
Broad-winged hawk	SC/RP	M	M	M	M
Brown thrasher	RP	M	M	M	I
Canada warbler	SC/RP	I	M	I	
Cattle egret	RP				M
Cerulean warbler	SC/RP	I		I	

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Birds (continued)					
Chimney swift	RP	I	I	I	I
Chuck-will's-widow	RP			R	R
Cliff swallow	SC	I		I	I
Common barn owl	SC	I	I		I
Common nighthawk	SC	I	M	M	M
Common tern	SC/RP		M		
Dickcissel	RP			M	M
Eastern kingbird	RP	I	I	I	I
Eastern meadowlark	SC/RP	I	I	I	I
Eastern screech-owl	RP	M	M	M	M
Eastern towhee	RP	I	I	I	I
Eastern wood-pewee	RP	I	I	I	I
Field sparrow	RP	I	I	I	M
Forster's tern	RP		M		M
Glossy ibis	RP		M		M
Golden-winged warbler	SC/RP	I			
Gray catbird	RP	M	M	M	M
Gray-cheeked thrush	SC	M			
Great blue heron	SC/RP	M	M	M	M
Great crested flycatcher	RP	M	I	M	I
Great egret	RP	M	M		M
Green heron	RP	I	M	I	I
Hooded warbler	RP	M	M	M	M
Horned grebe	RP		M		
Horned lark	SC		M	M	M
Indigo bunting	RP	I	I	I	I
Kentucky warbler	SC/RP	I	I	I	I
King rail	SC/RP	M			M
Least bittern	SC/RP	M	M	M	M
Least flycatcher	SC/RP	I	I	I	I
Little blue heron	SC/RP	I	I		I
Louisiana waterthrush	RP	M	M	M	M
Marsh wren	RP	M	M	I	I
Northern flicker	RP	M	M	M	I
Northern gannet	RP		M		M
Northern parula	SC	M	M	M	M
Pine warbler	RP	M	M	M	M
Prairie warbler	RP	I	I	I	I
Prothonotary warbler	RP	I		I	I
Purple finch	RP	R	R		R
Red-throated loon	RP		M		M
Rose-breasted grosbeak	RP	I	I	I	R
Saltmarsh sharp-tailed sparrow	RP	R	R	R	
Scarlet tanager	RP	M	M	M	I
Seaside sparrow	RP	R	R	R	R
Sharp-shinned hawk	SC/RP	M		M	M
Snowy egret	RP				I
Spotted sandpiper	SC	M	M	M	M
Summer tanager	RP	M	M	M	M
Veery	SC/RP	I	I	I	I
Whip-poor-will	RP		I	I	M
White-eyed vireo	RP	M	M	M	M
Willet	RP		M	M	M
Willow flycatcher	RP	I	I	I	I
Winter wren	SC	I		I	
Wood thrush	RP	I	I	I	I
Worm-eating warbler	RP	M	M	M	M
Yellow-billed cuckoo	RP	I	I	I	I
Yellow-breasted chat	SC/RP	I	I	I	I
Yellow-throated vireo	RP	M	M	M	I
Yellow-throated warbler	RP		M	M	M

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Reptiles					
Coastal plain milk snake	SC				M
Eastern box turtle	SC	M	M	M	M
Eastern kingsnake	SC				M
Northern copperhead	SC	M	M	M	
Northern diamondback terrapin	SC	M	M	M	M
Spotted turtle	SC	M	M	M	M
Amphibians					
Carpenter frog	SC			M	M
Fowler's toad	SC	M	M	M	M
Jefferson salamander	SC	M			
Northern spring salamander	SC	M	M		
Mollusks					
Creeper	SC				M
Insects					
Harris's checkerspot, <i>Chlosyne harrisii</i>	SC	M			
Clubtail dragonfly, <i>Gomphus septima</i>	S1, G2			M	
A noctuid moth, <i>Macrochila santerivalis</i>	S1S3, G3G4				M
Doll's merolonche, <i>Merolonche dolli</i>	S1S3, G3G4				M
A noctuid moth, <i>Chytonix sensilis</i>	S1S3, G4		M		M
Rare skipper, <i>Problema bulenta</i>	S2, G2G3				M
Lemmer's pinion moth, <i>Lithophane lemmeri</i>	S2, G3G4				M
A noctuid moth, <i>Cucullia alfarata</i>	S2, G4				M
Precious underwing, <i>Catocala pretiosa pretiosa</i>	S2S3, G4				M
A noctuid moth, <i>Macrochilo louisiana</i>	S2S3, G4				M
A slugmoth, <i>Monoleuca semifascia</i>	S2S3, G4G5				M
A spanworm, <i>Itame sp 1</i>	S3, G3				M
A noctuid moth, <i>Macrochilo sp 1</i>	S3, G3				M
Scarlet bluet, <i>Enallagma pictum</i>	S3, G3			M	M
<i>Zanclognatha sp 1</i>	S3, G3G4				M
Pink streak, <i>Faronta rubripennis</i>	S3, G3G4			M	M
Ringed boghaunter, <i>Williamsonia lintheri</i>	SH, G3	M			
Fish					
American brook lamprey***	RP	X	X	X	X
Atlantic sturgeon	SC* & RP			X	X
Bridle shiner	RP			X	X

2 *Federal species of special concern.

3 **Potential presence.

4 ***Species is also recognized as target species of ecoregional concern by the Nature Conservancy - NJ Chapter

5 SC: Species of special concern as identified within the state.

6 RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

7 S & G: Conservation Ranks defined in Appendix I.

8 M: Maintain population, species occurs within specific habitat(s) of landscape region.

9 I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

10 R: Research and restore population, suitable habitat, species presence unknown.

11 X: Species present. Management strategy not yet determined.

Table PP6. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Regional Priority	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Birds					
American black duck	RP	I	I	I	I
American woodcock	RP	I	I	I	I
Atlantic brant	RP		M		
Black scoter	RP		R		
Bufflehead	RP		M		
Canada goose (Atlantic population)	RP	M	M	M	M
Canvasback	RP		I		I
Clapper rail	RP		M		M
Greater scaup	RP		I		I
Lesser scaup	RP		I		I
Long-tailed duck	RP		R		
Northern bobwhite	RP		R	R	R
Northern pintail	RP		I		I
Surf scoter	RP		R	R	R
Virginia rail	RP	R	R	R	R
White-winged scoter	RP		R		
Wood duck	RP	M	M	M	M
Fish					
Brook trout*		X			X

*Species is a New Jersey game species, but is also an excellent indicator of water quality.

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

Table PP7. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Regional Priority	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Fish					
Comely shiner	-				X
Cutlips minnow	-	X			
Hickory shad	-			X	X
Ironcolor shiner	-				X
Margined madtom	-			X	X
Rainbow smelt	-				X
Shield darter	-		X	X	
Slimy sculpin	-	X			

X: Species present. Management strategy not yet determined.

Table PP8. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Regional Priority	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Mammals					
River otter	-	R	R	R	R
Birds					
Ruffed grouse	-	M	R	R	R
Sora	-	M	R	R	R
Fish					
Brown trout*	-	X			
Rainbow trout*	-	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

Table PP9. Suites of Wildlife and their Location in the Piedmont Plains Landscape

Common Name	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Mammals				
Forest-dwelling Bats	X	X	X	X
Birds				
Beach-nesting Birds		X		
Interior-forest Cavity-nesters	X	X	X	X
Savannah and Forest-edge Habitat Cavity Nesters	X	X	X	X
Coastal High Marsh Birds		X		
Coastal Low Marsh Birds	X	X		
Colonial Waterbirds	X	X	X	X
Forest Passerines	X	X	X	X
Freshwater Wetland Birds	X	X	X	X
Grassland Birds	X	X	X	X
Migratory Shorebirds		X		
Migratory Songbirds	X	X	X	X
Forest Raptors	X	X	X	X
Scrub-shrub/ Open Field (5-10 yrs) Birds	X	X	X	X
Early Succession (3 -5 years) Open Field Birds	X	X	X	X
Waterfowl	X	X	X	X
Reptiles				
Forest Dwelling Reptiles	X			
Reptile Inhabitants of Wetland, Marsh and Bog	X		X	X
Reptiles Associated with water (lakes, ponds, streams)	X		X	X
Reptiles of Special Concern	X	X	X	X
Amphibians				
Amphibians of Special Concern	X	X	X	X
Vernal Pool and Vernal Sinkhole Breeders	X		X	X
Non-vernal Sinkhole Inhabitants				
Limestone Fen Inhabitants	X			
Mollusks				
Mollusks of Special Concern			X	X

Suites of Wildlife and their Location in the Piedmont Plains Landscape (continued)

Common Name	Northern Piedmont	Raritan Bay	Central Piedmont	Southern Piedmont
Insects				
Lepidoptera of Federal or State Legal Status				
Lepidoptera of Special Concern	X		X	X
Odonata	X		X	X

X: Species occurs within the identified habitat.

E. Threats

The Piedmont Plains Landscape since 1972 has undergone extensive development, which has been accompanied by extensive habitat loss and fragmentation. Habitat loss and fragmentation are compounded by impacts from roads and development which include, but are not limited to, habitat degradation from human disturbance and heavy recreational uses, clearing of vegetation along rivers and streams (“stream encroachment”), habitat degradation from invasive plants, runoff of contaminants from roads and residential areas, increase in impervious surfaces, roads and development that act as barriers to wildlife movement, increased predation of wildlife by free-roaming housecats and edge-associated predators, loss of native plants and invertebrates, traffic noise that degrades habitat adjacent to roads, and greater road mortality (particularly of reptiles and amphibians).

In addition, protected natural lands that remain (state, county, non-government organization, private) act as a “magnet resource” attracting residential development that surround and isolates habitat patches. Isolated habitats can become cut off from other habitats, eliminating safe corridors for wildlife to travel between areas. Major impacts of habitat isolation include an overall reduction of wildlife diversity and an increased probability of local extinction of less-mobile wildlife populations. Moreover, in suburban forests and on private lands where hunting is not allowed burgeoning deer populations find refuge. Deer overbrowse destroys seedling trees and prevents forest regeneration; it also destroys habitat for other wildlife such as ground- and shrub-nesting birds. Consequently, these refugia, and some of our remaining public natural lands, are being severely damaged. Coupled with habitat loss and impacts from development, deer over-browse threatens the future of some of New Jersey’s forested lands. The difficulty of reducing the impact of deer is exacerbated by a growing reluctance among private landowners to allow hunting on their property, and the close proximity of development to natural lands limits or prohibits the use of firearms.

F. Priority Conservation Zones, Assessments, and Strategies within the Piedmont Plains

1. Northern Piedmont Plains

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Associated Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Partnerships to Deliver Conservation*
- g. Monitoring Success*

a. Habitats

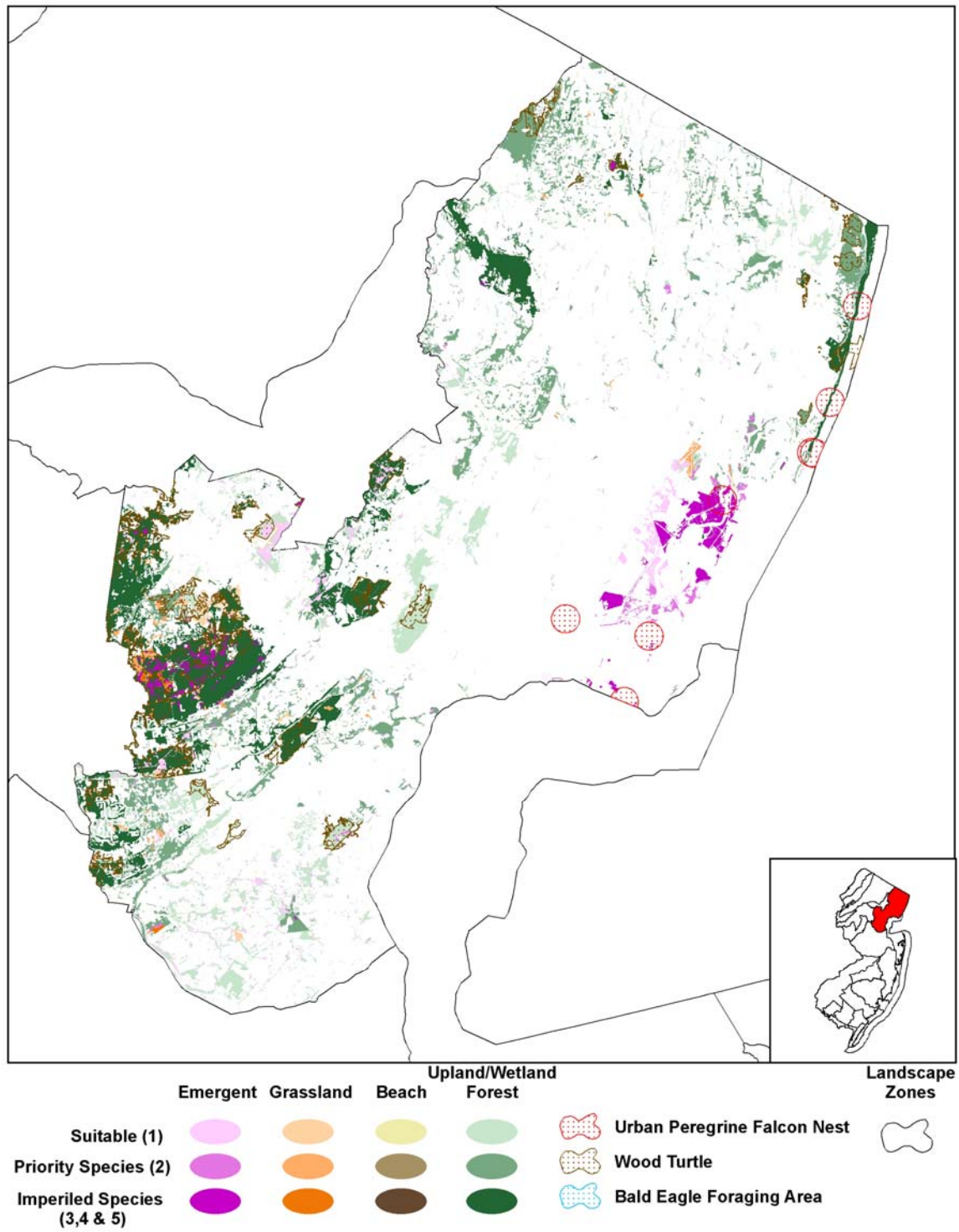
The Northern Piedmont Plains lies within parts of eight counties in northeastern New Jersey (Figure 18). This zone is extensively developed, and about 10 percent of this entire area is considered suitable for wildlife of conservation concern. The Palisades Interstate Park, Great Swamp National Wildlife Refuge, Hackensack Meadowlands, Preakness Mountain, and the network of riparian habitat and public land (mainly county land and watershed protection lands) provide habitat for the majority of endangered and threatened wildlife habitat in this zone.

Over 4,000 hectares or 15.4 square miles of emergent wetlands exist in the Northern Piedmont Plains, most of which occur in the Hackensack Meadowlands, Black Meadows, Great Swamp National Wildlife Refuge (NWR), and Saw Mill Creek Wildlife Management Area (WMA). Approximately 33,500 hectares or 129.3 square miles of forest (upland, wetland, riparian) also exist in the Northern Piedmont Plains. The largest patches (over 404 hectares, 998.3 acres) occur in a scattered network of public natural lands, including High Mountain, Washington Rock, Morristown National Park, and Palisades Interstate Park, with the largest patch (nearly 3,000 hectares, 11.6 square miles) in the Great Swamp NWR.

Early-succession and grassland habitat are scarce in this zone. Less than 1,500 hectares (5.8 square miles) of open fields, such as grasslands, pastures, or agricultural fields, most of which are in Harding Township in Morris County, provide habitat for a few endangered and threatened grassland species. Teterboro Airport, Piscataway Township in Middlesex County and the fields near the Great Swamp NWR contain the largest grassland patches in this zone. Utility rights-of-way provide some of the most critical scrub-shrub habitat for butterflies and species of conservation concern.

Unlike early-successional and grassland habitats, forests take many years to mature, develop a complex vegetative structure, and are difficult to retain in large, unbroken tracts. Therefore, forests (upland, wetland and riparian) are high-priority habitats in this zone. Forest areas should be maintained and allowed to increase in age and size if possible. Grassland and early succession habitats should be maintained where they exist and increased in size if possible. Grasslands in an agricultural matrix, forming a larger complex, can provide habitat for area-sensitive grassland species and a robust grassland wildlife community. However, grasslands and early-succession habitats should not be created at the expense of large or contiguous forests.

1 **Figure 18.** Critical landscape habitats within the Northern Piedmont Plains conservation zone,
 2 as identified through the Landscape Map (v2).



b. Wildlife of Greatest Conservation Need

The Northern Piedmont Plains supports one federal threatened, 13 state endangered, 12 state threatened, 71 special concern and regional priority species, and seven additional harvested species of regional priority. Species of special concern and regional priority include grassland dependent species, scrub-shrub birds, marsh birds, forest passerines, raptors, reptiles and amphibians, and invertebrates. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, are known to occur in the Northern Piedmont.

Upland and wetland forest at the western extent (especially Great Swamp NWR) and the northeast corner (Palisades Interstate Park) of this zone are important for area-sensitive forest species including the barred owl, red-shouldered hawk, and forest-nesting songbirds, and provide suitable habitat for Indiana and other forest-dwelling bats. The Palisades Interstate Park supports peregrine falcons and the last known remaining population of Allegheny woodrat and the Great Swamp NWR provides habitat for an extraordinary array of bird and amphibian species. These regions are oases surrounded by extensive development and are susceptible to impacts associated with development.

At the eastern extent of this zone, large rivers and associated freshwater wetlands, especially the Meadowlands, provide extensive breeding and foraging habitat for variety of freshwater marsh-nesting birds and long-legged wading birds (waterbirds) including pied-billed grebes, American bitterns, sedge wrens, northern harriers, black- and yellow-crowned night-herons, and insects such as the ringed boghaunter. These large expanses of wetlands and open water are important as migratory stopover and wintering areas for landbirds, waterbirds and waterfowl. Peregrine falcons breed here in good numbers, mainly on bridge structures.

Extensive rivers and streams, and associated habitats (“riparian habitats”) throughout the Northern Piedmont Plains provide habitat for a variety of forest reptiles and amphibians including wood, box and spotted turtles, blue-spotted and northern spring salamanders, and provide foraging and breeding areas for colonial waterbirds (mainly herons and egrets). For these suites of species, American beaver activity can be detrimental because it makes some areas unsuitable by creating permanent standing water bodies.

Although not abundant in this zone, scattered grasslands in the Northern Piedmont Plains provide habitat for savannah, grasshopper, and vesper sparrows; northern bobwhite quail, bobolinks, northern harriers, two insect species, American burying beetles and Harris’ checkerspot; and provide basking and nesting sites for turtles.

Finally, while most of the Northern Piedmont Plains zone is highly developed, urban/suburban habitat supports a number of species for which historical habitats have been significantly altered or reduced. Peregrine falcons, cliff swallows, chimney swifts, and nighthawks breed in highly urbanized areas and utilize man-made structures for nesting habitat. Concentrations of summer bats, including Indiana bats, may utilize buildings and alternative man-made roosts in order to raise their young. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Northern Piedmont Plains

Table PP10. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Reptiles				
Bog turtle		X		X
Insects				
American burying beetle ♦		X	X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table PP11. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Allegheny woodrat				X
Bobcat				X
Birds				
American Bittern		X		
Black skimmer		X		
Least tern		R	R	
Loggerhead shrike (migrant)		X		
Northern goshawk			X	
Northern harrier				X
Peregrine falcon		X	X	
Pied-billed grebe		X		
Red-shouldered hawk	X	X		
Sedge wren				X
Amphibians				
Blue-spotted salamander		X		X

R: Proposed reintroduction of species

X: Species occurs within the identified habitat.

Table PP12. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred Owl				X
Black-crowned night-heron		X		
Bobolink			X	
Cooper's hawk				X
Grasshopper Sparrow			X	
Long-eared owl			X	X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Yellow-crowned night-heron		X		
Reptiles				
Wood Turtle				X
Amphibians				
Long-tailed salamander				X
Insects				
Checkered white		R	R	R

R: Proposed reintroduction of species

X: Species occurs within the identified habitat.

1 Table PP13. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed myotis				X**
Eastern red bat				X**
Hoary bat				X**
Marsh rice rat			X	
Silver-haired bat				X**
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American golden-plover			X	
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blackburnian warbler				X
Black-throated blue warbler				X
Black-throated green warbler				X
Blue-headed vireo				X
Blue-winged warbler		X		X
Broad-winged hawk				X
Brown thrasher				X
Canada warbler				X
Cerulean warbler				X
Chimney swift				X
Cliff swallow		X		
Common barn owl			X	
Common nighthawk			X	X
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee			X	X
Eastern wood-pewee				X
Field sparrow			X	X
Golden-winged warbler				X
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Great egret		X		
Green heron		X		
Hooded warbler				X
Indigo bunting			X	X
Kentucky warbler				X
King rail		X		
Least bittern		X		
Least flycatcher				X
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Sharp-shinned hawk				X
Spotted sandpiper		X		
Summer tanager				X
Veery				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Willow flycatcher				X
Winter wren				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Reptiles				
Eastern Box Turtle			X	X
Northern copperhead				X
Northern diamondback terrapin		X		
Spotted Turtle		X		X
Amphibians				
Fowler's Toad		X		X
Jefferson salamander				X
Northern spring salamander				X
Insects				
Harris's checkerspot, <i>Chlosyne harrisii</i>			X	
Ringed boghaunter, <i>Williamsonia lintneri</i>	X			X
Fish				
American brook lamprey*	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy - NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table PP14. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		X
American woodcock				X
Canada goose (Atlantic population)	X	X		
Clapper rail		X		
Northern bobwhite			X	
Virginia rail		X		
Wood duck				X
Fish				
Brook trout*	X			

*Species is a New Jersey game species, but is also an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table PP15. Fish Species

Common Name	Water
Fish	
Cutlips minnow	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table PP16. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Ruffed grouse				X
Sora rail	X	X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Northern Piedmont Plains

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Northern Piedmont Plains is highly developed with scattered tracts of forest and wetlands, most of which are preserved in public natural lands and non-government organization conservation (NGO) lands. Loss and fragmentation of habitats on privately-held lands and isolation of protected natural lands through continued development and roads are the most significant threats to wildlife in this zone. Roads and development destroy and degrade habitat and are barriers to wildlife movements. Fragmentation of habitat allows for many invasive plant species to become integrated into natural areas thereby degrading habitat suitability for many species. Also, fragmentation increases stress on remaining trees, thereby increasing susceptibility of invasive pests (such as Asian longhorned beetles and gypsy moths). White-tailed deer thrive in fragmented non-urban areas and the resulting over-browse of the forest system in this landscape is severe and virtually eliminates forest regeneration. White-tailed deer also selectively browse vegetation, giving invasive species that they avoid eating (barberry species, etc) a stronghold in our forested understory.

The sinuous network of riparian corridors in the center of this zone provides the only safe egress for wildlife to disperse through developed regions. Stream encroachment is the leading cause of degradation of riparian ecosystems including habitat loss, increased water temperatures and runoff of contaminants. Invasive plants, such as common reed or *Phragmites* (*Phragmites australis*), and purple loosestrife (*Lythrum salicaria*) severely reduce suitability of wetlands for marsh-nesting birds. Breeding populations of non-native trout (brown and rainbow) resulting from stocking for recreational use compete with native populations of brook trout. Mute swans reduce abundance of submerged aquatic vegetation in many reservoirs and freshwater wetlands in the region. Furthermore mallards, which thrive in areas with human habitation, compete with and displace American black ducks and have also been known to hybridize with them. In the Northern Piedmont Plains, these riparian areas include Saw Mill Creek WMA, Hackensack Meadowlands, northern D&R Canal State Park, and other areas in eastern Hudson and northern Middlesex counties. North American beavers can create wetland habitat suitable for many species by damming up streams, but may, in turn, alter riparian habitat downstream from the dam.

Many forest and grassland species are area sensitive and their populations decline as habitat size decreases. Mowing/brush-hogging of fields, roadsides and utility rights-of-way during breeding season (mid-April through early July) increases mortality and reduces productivity of many birds, reptiles and amphibians, invertebrates, and small mammals.

Regional threats to priority species in urbanized areas such as chimney swifts, common nighthawks, cliff swallows, and peregrine falcons include changes in modern building construction that prohibit nesting and increase wildlife strikes. Urbanized areas also typically experience increased pesticide use for mosquito control. Additionally, the impact of free-ranging domestic and feral cats on wildlife is well documented and can severely impact and destroy important urban wildlife populations. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect, enhance, and restore critical habitats as identified by the Landscape Project, focusing primarily on habitat for forest-interior passerines, raptors and other forest-dwelling species and, secondarily, in areas where grassland and scrub-shrub wildlife communities currently exist.
- Protect, maintain, and/or enhance critical aquatic habitats and water quality to preserve populations of rare wildlife such as wood turtles, long-tailed salamanders, rare damselflies and dragonflies, and state or federal listed, special concern and coldwater fish species that rely on high water quality.
- Identify and protect important coastal wetland and early-successional habitats for colonial waterbirds and long-legged waders, grassland/open field/wetland butterflies and wintering/migratory bird populations.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Inventory and monitor all endangered, threatened, and special concern wildlife and fish species in this conservation zone; especially those groups with data gaps.
- Prevent and reverse declines of the Allegheny woodrat, peregrine falcon, reptiles and amphibians, birds, butterfly species of conservation concern, and native fish species; and conserve and enhance wild trout populations at optimal levels.
- Assess large-scale habitat change (every five to 10 years).
- Prevent illegal collection of rare reptiles and amphibians (including bog and wood turtles).
- Protect and enhance important and unique natural communities.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Protect, enhance, and restore coldwater fish habitat and ecosystems.
- Conserve and enhance wild trout populations at optimal levels.
- Promote public education and awareness and wildlife conservation, and participation in habitat restoration efforts on private land.

1 e. Conservation Actions

Priority	Conservation Actions
Protect critical habitat identified in the Landscape Project	
1°	Identify critical core forests, assess their condition for forest-nesting birds, and maintain information in the Landscape Project and Biotics database. Identify protection strategies (e.g., landowner incentives, acquisition) to maintain large core areas in perpetuity. Identify adjacent habitats that can be managed to increase the total size of forest habitat. (<i>Protect habitat – Landscape Project</i>)
1°	Identify critical grassland habitats and assess their condition for nesting birds, and maintain information in the Landscape Project and Biotics database. Identify protection strategies (e.g., landowner incentives, farmland preservation, acquisition) to maintain large existing core areas of grassland in perpetuity. Identify adjacent habitats that can be managed to enhance the total size of suitable grassland habitat. (<i>Protect habitat – Landscape Project</i>)
1°	Act to protect, maintain, enhance, restore, and/or create forest habitat, as appropriate: <ul style="list-style-type: none"> - Preserve forests with ≥ 10 hectares (24.7 acres) of forest core area (area of forest >90 meters or 98.4 yards from the forest edge), especially forests that are not near major highways; allow riparian areas to re-vegetate; avoid activities that cause breaks in the forest canopy and lead to fragmentation (roads, development); encourage forestry practices, such as uneven-age stand management, to retain old-growth forest, with complex forest structure, and abundant standing and fallen dead biomass. - Manage forests for larger, more mature woodlands with large trees for cavity-nesters and with a canopy closure of $> 80\%$. Maintain and enhance floodplain forests for area-sensitive forest passerines and manage forest habitats for woodland raptor suitability. Old-growth forested wetlands must be preserved for barred owls and red-shouldered hawks. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. (<i>Protect habitat – Landscape Project; Silviculture – land management</i>)
1°	Maintain and/or restore forested habitat corridors connecting patches of forest. (<i>Corridors – sprawl</i>)
1°	Identify, protect, and maintain coniferous and hemlock forests with $>70\%$ forest cover for priority bird species (black-throated green warbler, blue-headed vireo), reptiles and amphibians. (<i>Protect habitat – Landscape Project</i>)
1°	Protect habitat for fish by plotting distributions of special concern fish species and through concentrated field sampling for listed or special concern species at areas indicated by FishTrack Database queries. (<i>Protect habitat – fish; Monitor wildlife – fish</i>)
1°	Enhance and restore habitats through afforestation and revegetation where possible (forest and riparian habitats) and through active management (e.g., grasslands, wetlands, early-successional habitats, reduction of impacts from roads). (<i>Protect habitat – roads; Enhance habitat – private lands</i>)

1

Priority	Conservation Actions (continued)
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available. <i>(Protect habitat – Landscape Project)</i>
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, land acquisition priorities, and development of management strategies for permanently protected lands. <i>(Protect habitat – Landscape Project)</i>
1°	Use baseline data to develop management strategies for endangered, threatened and special concern wildlife on permanently protected natural lands. <i>(Conserve wildlife – rare wildlife)</i>
1°	Develop a landscape-scale plan to restore degraded emergent wetlands adjacent to the Meadowlands for colonial waterbirds, freshwater marsh birds and other wildlife relying on emergent wetlands. <i>(Protect habitat – Landscape Project; Enhance habitat – private lands)</i>
1°	Identify and protect important coldwater fish habitat and ecosystems. <i>(Protect habitat – Landscape Project, fish)</i>
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. <i>(Protect habitat – Landscape Project, migratory birds)</i>
1°	Select and manage woodlots to maintain dead trees, reduce understory, and thin tree stands for open-woodland species and cavity-nesters such as red-headed woodpeckers. <i>(Silviculture – land management; Protect habitat – Landscape Project)</i>
1°	Select and manage woodlots to maintain structural forest diversity, esp. shrub understory for forest passerines (cerulean warblers, Kentucky warblers, Louisiana waterthrushes, wood thrushes) and priority reptiles, amphibians, and invertebrate species. <i>(Silviculture – land management; Protect habitat – Landscape Project)</i>
2°	Encourage creation of multiple culverts in road construction to widen stream flow for fish and wildlife passage and maintain natural streambed. <i>(Corridors – roads; Protect habitat – roads, fish)</i>
Protect, maintain, and/or enhance critical aquatic habitat of rare fish species	
1°	Protect water quality by seeking possible Category 1 antidegradation designations in waterbodies where listed or special concern species occur. <i>(Protect habitat – fish)</i>
1°	Continue to classify waters according to their suitability for trout and provide recommendations for surface water classification changes to the Department of Environmental Protection. <i>(Monitor wildlife – fish; Protect habitat – fish)</i>
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. <i>(Monitor wildlife – fish)</i>
1°	Develop and implement a habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. <i>(Restore aquatic habitat – development)</i>

1

Priority	Conservation Actions (continued)
2°	Identify and research water quality parameters for wood turtle and special concern amphibian populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Research effects of parasites and diseases on special concern fish species' populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	DFW to give priority attention to species of greatest conservation need in planning or implementing any response to any exotic pathogen introduction or incident. (<i>Conserve wildlife – rare wildlife, invasives</i>)
Identify and protect important wetlands and early-successional habitats	
1°	Preserve all large (> 4.8 hectares or 11.8 acres) freshwater wetlands from development, draining, and other forms of habitat loss. (<i>Protect habitat – development, humans</i>)
1°	Maintain larger buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat – Landscape Project</i>)
1°	Wetlands used as breeding sites should be protected from chemical contamination, siltation, eutrophication, and other forms of pollution/contamination that could directly harm breeding species or their food supply (including birds, amphibians, and invertebrates). (<i>Conserve wildlife – contaminants</i>)
1°	Collaborate with other agencies and conservation groups that collect data on breeding and wintering wildlife populations (New Jersey Meadowlands Commission, Hackensack and Hudson Riverkeepers, etc.) to identify and protect important habitats. (<i>Protect habitat – Landscape Project</i>)
1°	Maintain grassland and early-successional habitats where they occur; do not expand or create grassland and early-successional habitat at the expense of large forests. Acquire grassland habitat through direct purchase or easements; enlist private lands in preservation and management programs that offer long-term stability of a matrix of grassland schemes. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Develop and implement best management practices for grasslands to improve habitat quality for grassland species and prevent destruction of nests and young, eggs and larvae by early mowing. Guide private and public landowners to implement best management practices for species dependent on grassland and scrub-shrub communities. (<i>Agriculture – land management; Enhance habitat – private lands</i>)
1°	Restore and enhance forest, emergent, riparian, and coastal wetlands (Hackensack Meadowlands) on permanently protected natural lands and surrounding private lands. (<i>Enhance habitat – private lands</i>)
1°	Collaborate with Hackensack and Hudson Riverkeepers to carry out wildlife surveys including birds and invertebrates. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Maintain and enhance riparian areas and associated wetlands for bog turtles, songbirds, raptors, long-legged wading birds, riparian reptiles and amphibians and invertebrates; encourage larger buffers for riparian areas and wetlands in permits as appropriate to provide egress for wildlife in developed regions and prevent degradation of riparian habitats. (<i>Protect habitat – development; Enhance habitat – private lands</i>)
1°	Support research to identify methods to rid grasslands and wetlands of invasive and nuisance vegetative species. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
1°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulations database and Landscape Project (<i>Protect habitat – Landscape Project</i>)
2°	Collaborate with large landfill operations in New Jersey and New York to promote planting and management of capped landfills for grassland birds. (<i>Enhance habitat – private lands</i>)
2°	Identify and maintain wetlands with dead trees for red-headed woodpecker and other cavity-nesters. (<i>Protect habitat – development; Silviculture – land management</i>)
2°	Maintain and enhance floodplain habitats for wildlife and storm water control. (<i>Protect habitat – development; Enhance habitat – private lands</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Identify areas where invasive, non-indigenous plants and animals are either already established or are becoming established through surveys and public participation. Prioritize areas for control measures. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the Asian longhorned beetle and gypsy moth. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>).
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. (<i>Evaluate restoration – deer; Conserve wildlife - deer</i>)

1

Priority	Conservation Actions (continued)
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Evaluate restoration – deer; Conserve wildlife – deer</i>)
1°	Develop and implement, through regulations or legislation, programs that require farmers to achieve deer management goals, including harvest quotas, to obtain farm tax assessment or to qualify for farmland preservation programs. (<i>Conserve wildlife – deer</i>)
2°	Support research to identify methods to rid forests of invasive and nuisance vegetative species. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
2°	Request permission from private landowners (both those who allow hunting and do not allow hunting) to establish vegetation monitoring plots. This will allow greater surveillance of deer impacts on private lands, provide landowners direct information about the health of their land, and provide greater data input into the deer harvest formula. (<i>Evaluate restoration – deer</i>)
Inventory and monitor endangered, threatened, and special concern wildlife	
1°	Systematically survey the Northern Piedmont Plains zone, particularly Teterboro Airport, Hackensack Meadowlands, Great Swamp NWR, and areas in Piscataway, South Plainfield, Warren, Harding, Hanover, West Caldwell, and Bergen County for songbirds, raptors, colonial waterbirds, grassland/open-field and wetland butterflies, and waterfowl. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Through national, standardized survey protocols, continue long-term monitoring of raptor, songbird, reptile, amphibian, colonial waterbird, and aquatic invertebrate populations, and incorporate new information into Landscape Project mapping. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Promote coordination of species monitoring and management efforts among conservation groups and state agencies in New Jersey; including standardized monitoring methods for birds and reptiles and amphibians.
1°	Collaborate with conservation organizations to inventory acquired land and update Landscape Project mapping as data become available. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify key breeding locations for cliff swallows and common nighthawks for immediate conservation efforts. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Identify and acquire data in areas where species data and monitoring gaps exist, particularly in the Hackensack Meadowlands. (<i>Monitor wildlife – long-term monitoring</i>)

2

1

Priority	Conservation Actions (continued)
1°	Survey to collect baseline data and develop management strategies for endangered, threatened and special concern wildlife on permanently-protected natural lands. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify and inventory coastal and inland wetlands important for colonial waterbirds, long-legged waders, marsh-nesting birds, and waterfowl for which we have little data. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify and inventory areas suitable for American burying beetles, Harris' checkerspots, ringed boghaunters, long-tailed salamanders, saltmarsh sharp-tailed sparrows, seaside sparrows, and purple finches. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Monitor and develop management strategies for coldwater fisheries in large reservoirs. (<i>Monitor wildlife – fish</i>)
1°	Routinely monitor fish populations, including wild trout, in order to keep management strategies current, aid in the identification of resource problems and issues, and demonstrate agency commitment to the management of aquatic resources. (<i>Monitor wildlife – fish</i>)
2°	Develop protocol to monitor abundance and distribution of colonial waterbirds north of the Coastal Landscape; incorporate these data and other data from the area into Landscape Project mapping. (<i>Monitor wildlife – long-term monitoring</i>)
Prevent and reverse declines of wildlife populations	
1°	Work with managers to manage impoundments to benefit bitterns, rails, ducks and some invertebrates by providing suitable foraging habitat and encouraging dense stands of emergent vegetation for nesting. (<i>Protect habitat – humans</i>)
1°	Continue research and monitoring of Allegheny woodrat populations in the Palisades, including control of impact from disease. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Maintain and enhance reptile and amphibian populations, particularly those that are endangered because of illegal collection for the pet trade (bog and wood turtles, pine and corn snakes) and those populations most susceptible to road mortality (known box turtle breeding locations near roads). (<i>Conserve wildlife – rare wildlife; Protect habitat – roads; Corridors – roads</i>)
1°	Identify groundwater recharge areas for blue-spotted salamander breeding sites. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop best management practices (BMPs) for utility rights-of-way (ROWs) to reduce impacts of vegetation management practices on wildlife and enhance scrub-shrub habitat. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Manage freshwater wetlands for pied-billed grebes: create impoundments, maintain stable water levels during nesting season, restrict recreational activity, monitor contaminant levels; hemi-marsh conditions (approximately 50% water and 50% emergent vegetation cover) favored by grebes need to be maintained by periodic reversal of vegetation succession to open up some of the extensive stands of emergent vegetation, but suitable habitat for nesting needs to be maintained in nearby areas during wetland management. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
1°	Identify areas where scrub-shrub habitat can be created and/or maintained with little impact to forested, wetland, and grassland habitats to maintain populations of shrub-dependent butterflies, reptiles, amphibians, and scrub-shrub birds such as American woodcocks and golden-winged warblers. (<i>Protect habitat – Landscape Project</i>)
1°	Conduct surveys to find more information about the species and management requirements of rails. (<i>Conserve wildlife – rare wildlife</i>)
1°	Prevent fish declines by utilizing the Delphi process initiated by the Division of Fish and Wildlife in 2003 to determine fish species that may warrant “special concern status.” (<i>Status – fish</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect aquatic wildlife – humans</i>)
1°	Develop management strategies to assure the protection of the state’s valuable wild coldwater fisheries. (<i>Protect aquatic wildlife – humans</i>)
1°	Evaluate current management practices that may negatively impact wild trout populations. (<i>Protect aquatic wildlife – humans</i>)
1°	Identify threats to vernal pools and devise strategies to protect species dependent upon vernal pool habitat. (<i>conserve wildlife – rare wildlife</i>)
2°	Develop an appropriate survey method for tracking populations of chimney swifts and common nighthawks and conduct a thorough status assessment of these species. (<i>Conserve wildlife – rare wildlife</i>)
2°	Compile better life history information on urban species, such as kinds of nest predators and levels of nest depredation, breeding longevity and reproductive effort over time, characteristics of preferred nesting requirements, fidelity to breeding and wintering sites, and better assessment of migration routes and destinations. (<i>Monitor wildlife – long-term monitoring</i>)
2°	Identify areas with known wildlife mortality issues including building strikes and road crossings for breeding amphibians, and roads with high-densities of wildlife mortality (snakes, turtles, large mammals). (<i>Protect habitat – roads; Corridors – roads</i>)
Assess large-scale habitat change every five years	
1°	Collaborate with NJ DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years.

2

Priority	Conservation Actions (continued)
1 ^o	Perform critical habitat change analysis to assess trend in habitat loss and conversion. (<i>Protect habitat – Landscape Project</i>)
Prevent illegal collection of rare reptiles and amphibians	
1 ^o	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnake), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
2 ^o	Recruit and educate local law enforcement of endangered species laws. Develop a partnership between them and the NJ Division of Fish and Wildlife's Bureau of Law Enforcement to enforce protection of native wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
Protect and enhance important and unique habitats	
1 ^o	Work with state agencies and local governments to map significant natural communities in the Northern Piedmont Plains. (<i>Protect habitat – Landscape Project</i>)
1 ^o	Identify, protect, and enhance critical migratory stopover habitats such as Great Swamp NWR and Hackensack Meadowlands. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1 ^o	Continue to support the protection of the large wetland complex of the Great Swamp National Wildlife Refuge. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1 ^o	Continue to support the protection of Palisades Interstate Park and the globally rare species that occur there. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1 ^o	Work with local governments and NJ DEP's Natural Heritage Program (NHP) to protect and enhance the traprock glade natural community and endangered plant species at Chimney Rock. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1 ^o	Work with local governments and NHP to protect and enhance the natural community and endangered plant species at Seeleys Pond. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1 ^o	Work with local governments and NHP to protect and enhance the globally imperiled natural community at the Preakness Mountain macrosite. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat	
1 ^o	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic, colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Protect, enhance, and restore coldwater fish habitat and ecosystems	
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Develop and implement a habitat improvement and restoration program. (<i>Restore aquatic habitat - development</i>)
1°	Monitor changes in water quality on specific waterways where summer trout habitat may be in jeopardy due to declining water quality. (<i>Monitor wildlife – fish</i>)
Conserve and enhance wild trout populations at optimal levels	
1°	Routinely monitor wild trout populations to revise management strategies when appropriate, aid in the identification of resource problems and issues, and demonstrate agency commitment to the management of aquatic resources. (<i>Monitor wildlife – fish</i>)
1°	Evaluate current management practices that may negatively impact wild trout populations. (<i>Protect habitat – humans</i>)
1°	Protect wild trout populations through the use of established fishing regulations. (<i>Protect aquatic wildlife – humans</i>)
Promote public education and awareness and wildlife conservation	
1°	Educate homeowners about habitat requirements of chimney swifts and discourage use of chimney caps where possible. (<i>Education – humans</i>)
1°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)

1

Priority	Conservation Actions (continued)
1°	Educate public about keeping cats indoors; work to develop a statewide policy for local communities to discourage managed cat colonies and trap, neuter and release programs. (<i>Education – humans; Conserve wildlife – cats, subsidized predators</i>)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants and fish to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is the key to successful control. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
2°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
2°	Develop and maintain educational materials about nongame and coldwater fish for dissemination to the public. (<i>Education – humans</i>)

2

3 **f. Potential Partnerships to Deliver Conservation**

4 Private Landowners

- 5 • Maintain and enhance habitat through innovative partnerships with private landowners.
 - 6 ○ Implement best management practices that protect nesting and foraging sites of
 - 7 ospreys, peregrine falcons, woodland raptors, and grassland birds.
 - 8 ○ Utilize state, federal and local wildlife incentive programs that encourage the
 - 9 management of bog turtle, forest and grassland bird populations.
 - 10 ○ Through incentive programs, target private landowners surrounding public natural
 - 11 lands to manage land for mature forest in order to increase effective size and
 - 12 connectivity of forest patches.
 - 13 ○ Encourage farmers to preserve farmland through conservation easements or Transfer
 - 14 of Development Rights (TDRs) through partnerships with SADC, NJ DEP's Green
 - 15 Acres Program, The Nature Conservancy – NJ Chapter, local land trusts, and local
 - 16 municipalities for the conservation of bog turtle, forest and grassland bird
 - 17 populations.
 - 18 ○ Develop/maintain cooperative relationships with Teterboro Airport to encourage the
 - 19 management of grasslands for species of conservation concern.
 - 20 ○ Collaborate with municipal landfill operations to encourage grassland management
 - 21 on capped landfills.
 - 22 ○ Encourage landowners to allow afforestation of riparian zones utilizing landowner
 - 23 incentive programs.
 - 24 ○ Encourage landowners to manage nesting locations for chimney swifts and common
 - 25 nighthawks
 - 26 ○ Continue to coordinate maintenance and restoration of bog turtle habitat with private
 - 27 landowners on a volunteer basis.

- Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
- Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant populations. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
- Work with landowners to maintain/enhance existing habitats where listed and special concern fish species and native trout populations occur.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, Conserve Wildlife Foundation, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter and NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
 - Collaborate with Conserve Wildlife Foundation, NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species
 - Involve Citizen Scientists in monitoring and assessment of chimney swift and common nighthawk occurrences and nesting areas.
 - Continue volunteer-based summer bat concentration surveys.
- Collaborate with NJ Audubon Society to educate public on the effects of free-roaming domestic cats and feral cats on wildlife species of conservation concern.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds.
- Promote backyard habitat management for reptiles, invertebrates, migratory raptors, and passerines.
- Work with landowners to maintain/enhance existing habitats where listed special concern species occur.
- Work with landowners to maintain/enhance existing trout populations.

Wildlife Professionals

- Consult with entomologists to design and conduct surveys for Harris' checkerspots in grasslands and other appropriate habitat.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Develop a working relationship with the American Museum of Natural History Center for Biodiversity and Conservation in support of the existing Metropolitan Biodiversity Program.
- Partner with New Jersey Meadowlands Commission, Hackensack Riverkeeper, NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect osprey, peregrine falcon, and woodland raptor nesting and foraging sites.
 - Maintain emergent wetlands and open water for American bitterns, pied-billed grebes, sedge wrens, colonial waterbirds, and other marsh birds of concern as well as invertebrates (butterflies, dragonflies and damselflies).
 - Initiate and support eradication efforts of invasive plant and vertebrate species and exotic pathogens.
 - Develop a plan based on the survey results and habitat recommendations of the Hackensack Meadowlands study.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
 - Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants and invertebrates.
- Develop effective and coordinated monitoring and data-sharing methods with conservation groups to fill data gaps and enable new species data to be incorporated into Landscape Project and the Biotics database
- Collaborate with NJ Audubon Society on designating Important Bird Areas and fill gaps in baseline data.
- Consult with conservation organizations to develop educational programs.
- Encourage the use of priority habitat maps to guide land acquisition by conservation organizations through programs such as Green Acres Program, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Continue to develop partnerships with fishing- and conservation-oriented organizations to increase conservation and restoration efforts on streams and lakes that provide trout fishing opportunities.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other farm conservation programs.
- Work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.
- Continue to develop partnerships with fishing and conservation oriented organizations to increase conservation and restoration efforts on streams and lakes supporting native trout populations.

Academic Institutions

- Partner with Rutgers and other academic institutions to conduct studies necessary to better understand the impacts of deer on biodiversity, forest health, and ecosystem processes and to develop habitat-specific or landscape-specific deer density targets.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, US Department of Agriculture (USDA) including Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS) - NJ Field Office, Green Acres Program, State Agricultural Development Committee (SADC) Farmland Preservation, and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to maintain and protect osprey, peregrine falcon, woodland raptor and forest songbird nesting and foraging sites.
 - DFW and the USFWS to develop a plan to protect sensitive bog turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle sites.
 - Determine groundwater recharge areas for bog turtle habitats with the Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality in these areas.
 - DFW, National Park Service, conservation organizations, and DEP's Lands Use Regulation Program (LURP) to work to protect and appropriately classify wetlands for special concern invertebrate, reptile, and amphibian populations on state, federal, and private lands.
 - DFW to lead in the development of specific conservation plans develop specific conservation plans for special concern birds, reptiles and amphibians, and invertebrates on state lands.
 - DFW to identify areas where scrub-shrub macro-sites can be created and/or maintained for American woodcocks and ruffed grouse without negatively affecting endangered, threatened, or special concern species and their habitats.
 - Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and other forest dwelling species on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
 - DFW, conservation organizations, and land stewards to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, and invertebrates with the DEP's Division of Watershed Management. Partner with them to investigate water quality and threats of contaminants/pollution.
 - DFW to work with the NJDPF to enhance state forests for wildlife: uneven-age stand management, preserve standing and fallen dead biomass, eliminate forestry practices in wetland forests and manage adjacent upland forest for older-growth.
 - DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
 - DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.

- DFW and DEP's Division of Parks and Forestry (DPF) to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive, non-indigenous plants on federal and state lands and aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to continue to interact with other state agencies on operational, regulatory, and land-use issues to ensure adequate consideration is given to coldwater fish resources.
- DFW to continue to participate in the review of Land Use Applications that have the potential to impact wild trout populations and rare aquatic species.
- DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
- DFW to coordinate with the NJ Department of Transportation to reduce road mortality to reptiles and amphibians and large mammals and create wildlife under- and overpasses on new roads and road upgrades.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW to work with land management agencies at state local and federal level to implement deer management plans that achieve desired deer densities on lands that they oversee.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with DEP's Bureau of Water Monitoring and Standards to recommend classification upgrades in water bodies where listed or special concern species occur.
- Develop effective and coordinated monitoring and data-sharing methods with Great Swamp National Wildlife Refuge, Palisades Interstate Park, watershed management areas, and NJDFW to fill data gaps and enable new species data to be incorporated into Landscape Project and the Biotics database.
- DFW to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to continue to interact with other state agencies on operational, regulatory, and land-use issues to ensure adequate consideration is given to coldwater fish resources.
- DFW to continue to participate in the review of Land Use Applications that have the potential to impact wild trout populations.
- DFW, USFWS, and US Department of Agriculture to continue monitoring diseases that can potentially affect wild, native populations of special concern fish species.

- DFW to continue working with fishing clubs and organizations, lake communities, hatcheries nationwide, and individuals permitted to stock fish in NJ's freshwater streams and lakes to ensure healthy stock is used to minimize the spread of disease and parasites to native fish species and to prevent the use or release of exotic species.
- DFW to lead in the development of educational materials for public and private landowners about wildlife of greatest conservation need and associated habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and colonial waterbird viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat change over time to assess efficacy of habitat management and restoration efforts.
- Incorporate standardized monitoring protocols, measures of success, and timeline for monitoring activities into mitigation projects and habitat conservation plans.
- Annually monitor abundance, productivity, distribution, and trends of bald eagle, osprey (biannually), peregrine falcon, and bog turtle populations; and colonial waterbird, grassland bird, and raptor communities.
- Monitor bald eagle contaminant levels.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, the Vernal Pool Project, and the volunteer coverboard surveys.
- Conduct long-term monitoring of vegetative plots (exclosures) within state lands to assess vegetative success/ failure over time as deer densities change.
- Evaluate success of management activities on private land funded by state, federal and private landowner incentive programs.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants, vertebrates, and invertebrates.
- Continue to monitor deer densities and deer harvest data.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.
- Continue monitoring diseases as outlined in the DFW's annual Fish Health Management Plan.

2. Raritan Bay and North Atlantic Coast

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

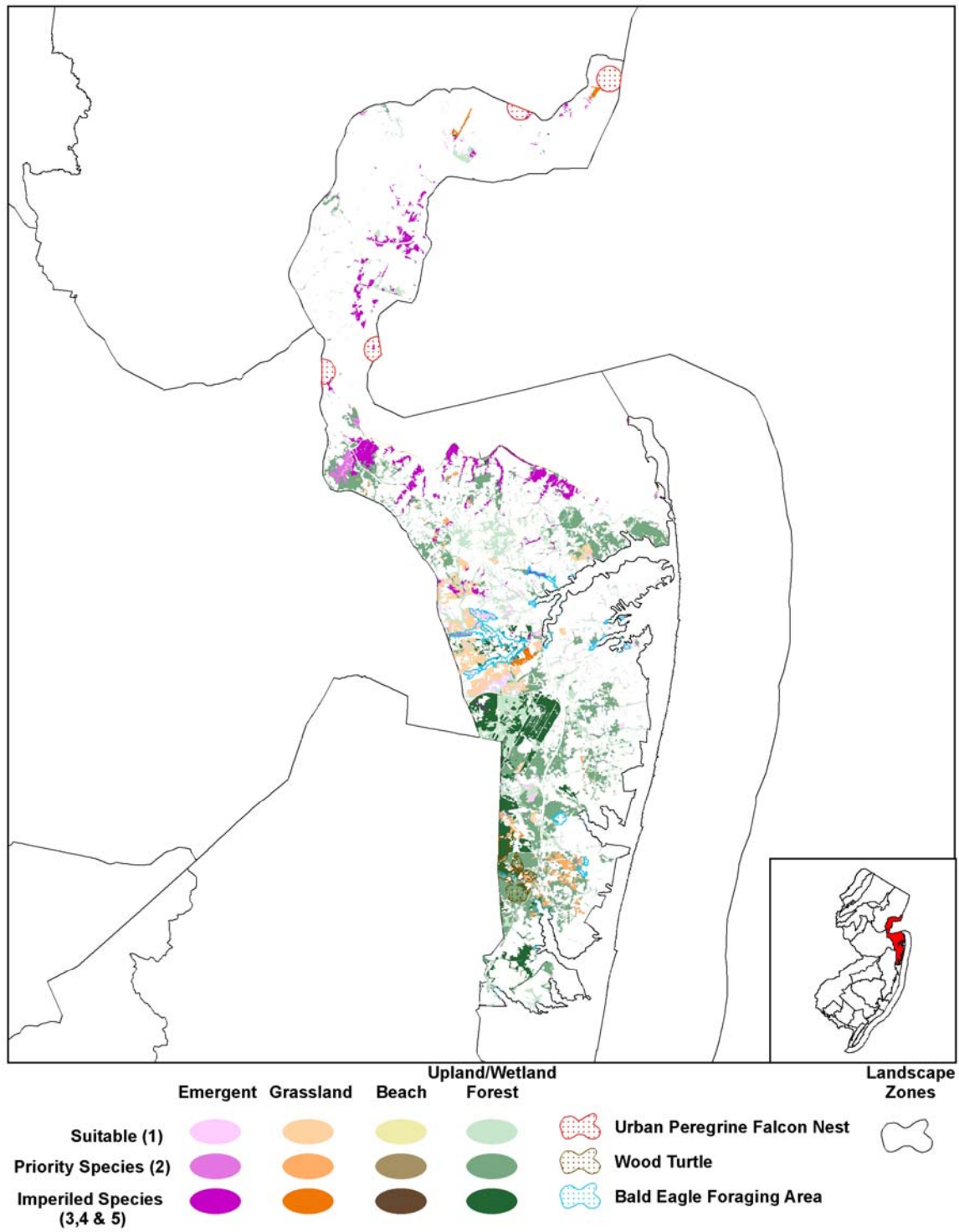
The Raritan Bay zone is located along the coastal areas of Essex, Hudson, Union, Middlesex), and Monmouth Counties (Figure 19). This zone contains parts of Allaire, Cheesequake, and Liberty State Parks, Manasquan River WMA, and Earl Naval Base.

Though largely developed, the Raritan Bay zone is extraordinary because of its extensive network of freshwater streams, ponds, major rivers, and their estuaries (Hudson, Raritan, Manasquan, Shark, Shrewsbury and Navesink) that drain into the Raritan Bay and Atlantic Ocean. Approximately 2,600 hectares or 10 square miles of open wetlands are in the Raritan Bay zone, with the largest wetland patches occurring west of Sandy Hook along the northern coastline of the Raritan Bay and Cheesequake State Park.

Nearly 20,000 hectares (77.2 square miles) of forested habitat (upland and wetland) with patch sizes ranging from less than 0.2 hectares (half an acre) to just under 2,000 hectares (4,942 acres) (Earl Naval Base), dot the landscape of the Raritan Bay. However, less than one fourth of the forest patches here are large enough to support wildlife of conservation concern without the detrimental effects of fragmentation. The southern portion of this zone contains large tracts of upland and wetland forest in Allaire State Park, Earl Naval Base, and various watershed management areas. Approximately 2,800 hectares or 10.8 square miles of open-field habitat (grasslands, pastures, and/or agriculture), with patch sizes ranging from 0.2 hectares (half an acre) to approximately 162 hectares (400 acres), are clustered in the Monmouth County portion of the Raritan Bay. Despite the expanse of open habitat in this area, less than half of the patches meet the minimum size requirement for area-sensitive grassland birds (10 hectares, 24.7 acres), let alone the more than 200 hectares (> 494 acres) needed to support a viable population of breeding upland sandpipers. Allaire, Newark, and Hop Brook Farm airports contain large patches of grasslands. Other areas with significant areas of open-field habitat include Colts Neck, Holmdel, and Wall Township in Monmouth County.

In summary, the priority habitats in this zone from north to south are: 1) estuaries and associated coastal wetlands, 2) riparian areas and associated forest/emergent wetlands, 3) large contiguous upland and wetland forests, 4) grasslands and early-succession habitats, which should be maintained and enhanced where they exist.

1 **Figure 19.** Critical landscape habitats within the Raritan Bay and North Atlantic Coast
 2 conservation zone, as identified through the Landscape Map (v2).



b. Wildlife of Greatest Conservation Need

The Raritan Bay provides habitat for two federal threatened species, seven state endangered species, eleven state threatened species, 71 special concern and regional priority species, and 17 additional harvested regional priority species.

Large expanses of marsh and riparian areas retain significant open water, emergent, forested, and coastal wetlands that provide extensive foraging habitats throughout the zone for least terns, colonial waterbirds, ospreys, freshwater wetland birds, spotted turtles, and Fowler's toads. Raritan Bay winters one of the largest concentrations of greater and lesser scaup in the Atlantic Flyway. Peregrine falcons breed on bridge structures in the northern reach of this zone and Monmouth County riparian forests and open water support breeding bald eagles and forest songbirds. Large forest tracts border the Pinelands Landscape and support forest-interior raptors (red-shouldered hawks, barred owls, Cooper's hawks) and forest-interior songbirds (black-throated green warblers, scarlet tanagers) These forest tracts are also vital for Pine Barrens treefrogs, wood turtles and other reptiles and amphibians, as migratory stopover for songbirds, and as foraging, roosting and breeding habitat for forest-dwelling bats. Early-succession habitat, is composed of two distinct habitat types, grassland and scrub-shrub, provide habitat for grassland and scrub-shrub birds, including upland sandpipers and savannah sparrows, breeding and nectaring areas for invertebrates (lepidoptera), and nesting and basking sites for turtles. Cliff swallows, chimney swifts, and concentrations of summer bats can breed in highly urbanized areas and utilize man-made structures for breeding habitat. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Raritan Bay and North Atlantic Coast

Table PP17. Federal Endangered and Threatened Species*

Common Name	Water	Beach and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals					
Indiana bat					X**
Birds					
Bald eagle			X		X
Reptiles					
Bog turtle			X	X	X
Insects					
American burying beetle ♦			X	X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦ Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table PP18. State Endangered Species

Common Name	Water	Beach and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
Black skimmer		X	X		
Henslow's sparrow			R	R	
Least tern		X	X		
Northern harrier			X	X	
Peregrine falcon			X		
Pied-billed grebe	X		X		
Red-shouldered hawk					X
Upland sandpiper				X	

R: Proposed reintroduction of species

X: Species occurs within the identified habitat.

Table PP19. State Threatened Species

Common Name	Water	Beach and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
Barred owl					X
Black-crowned night-heron		X	X		
Cooper's hawk					X
Grasshopper sparrow				X	
Osprey		X	X		
Savannah sparrow				X	
Yellow-crowned night-heron		X	X		
Reptiles					
Northern pine snake				X	X
Wood turtle			X	X	X
Amphibians					
Pine Barrens treefrog			X		X
Invertebrates					
Checkered white			X	X	X

X: Species occurs within the identified habitat.

Table PP20. Nongame Species of Conservation Concern

Common Name	Water	Beach and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals					
Eastern small-footed myotis					X**
Eastern red bat					X**
Hoary bat					X**
Marsh rice rat				X	
Silver-haired bat					X**
Southern bog lemming					X
Birds					
Acadian flycatcher					X
American kestrel				X	
American oystercatcher		X			
Baltimore oriole					X
Black-and-white warbler					X
Black-billed cuckoo					X
Black-throated green warbler					X
Blue-headed vireo					X
Blue-winged warbler			X		X
Broad-winged hawk					X
Brown thrasher					X
Canada warbler					X
Chimney swift					X
Common barn owl				X	
Common nighthawk		X		X	X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Beach and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)					
Common tern		X			
Eastern kingbird				X	
Eastern meadowlark				X	
Eastern screech-owl					X
Eastern towhee					X
Eastern wood-pewee					X
Field sparrow				X	
Forster's tern		X	X		
Glossy ibis			X		
Gray catbird					X
Great blue heron			X		
Great crested flycatcher					X
Great egret			X		
Green heron			X		
Hooded warbler					X
Horned grebe			X		
Horned lark		X		X	
Indigo bunting				X	X
Kentucky warbler					X
Least bittern			X		
Least flycatcher					X
Little blue heron			X		
Louisiana waterthrush					X
Marsh wren			X		
Northern flicker					X
Northern parula					X
Northern gannet		X			
Pine warbler					X
Prairie warbler					X
Purple finch					X
Red-throated loon		X	X		
Rose-breasted grosbeak					X
Saltmarsh sharp-tailed sparrow			X		
Scarlet tanager					X
Seaside sparrow			X		
Spotted sandpiper			X		
Summer tanager					X
Veery					X
Whip-poor-will					X
Willet		X	X		
Willow Flycatcher					X
Wood thrush					X
Worm-eating warbler					X
Yellow-billed cuckoo					X
Yellow-breasted chat					X
Yellow-throated vireo					X
Yellow-throated warbler					X
Reptiles					
Eastern box turtle				X	X
Northern copperhead					X
Northern diamondback terrapin			X		X
Spotted turtle			X	X	X
Amphibians					
Fowler's toad				X	X
Northern spring salamander				X	X
Insects					
A noctuid moth, <i>Chytonix sensilis</i>					X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Beach and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Fish					
American brook lamprey*	X				X

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy - NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table PP21. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Beaches and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Birds					
American black duck	X		X		X
American woodcock					X
Atlantic brant	X				
Black scoter	X				
Bufflehead	X				
Canada goose (Atlantic population)	X		X		
Canvas back	X				
Clapper rail			X		
Greater scaup	X				
Harlequin duck*	X		X		
Lesser scaup	X				
Long-tailed duck	X				
Northern bobwhite				X	
Northern pintail	X				
Virginia rail			X		
White-winged scoter	X				
Wood duck					X

*Species considered regional priority, but New Jersey is not significant in the populations survival.

X: Species occurs within the identified habitat.

Table PP22. Fish Species

Common Name	Water
Fish	
Shield darter	X

X: Species occurs within the identified habitat.

Table PP23. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Beaches and Dunes	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals					
River otter	X		X		
Birds					
Ruffed grouse					X
Sora rail			X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Raritan Bay and North Atlantic Coast

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Although most of the large patches of suitable habitat are owned by municipal, county, state, and federal entities, this zone is fairly well developed. Habitat loss and fragmentation and human disturbance are the greatest threats in this zone.

Major waterways in this zone are situated in the New York metropolitan area and support some of the largest petro-chemical facilities in the U.S. As such, this zone faces spill and contaminants related threats that could be potentially catastrophic. This zone receives heavy recreational use of rivers and coastal waters by boats and personal watercraft, which can interfere with the breeding and foraging of bald eagles and colonial waterbirds. Loss and fragmentation of habitats and isolation of protected natural lands by development and roads are significant threats to wildlife in this zone. Roads and development destroy and degrade habitat and act as barriers to wildlife movements. Fragmentation of habitat allows for many invasive plant species to become integrated into natural areas, thereby degrading habitat suitability for many species. Additionally, fragmentation increases stress on the remaining trees thereby, increasing susceptibility of invasive pests (such as Asian longhorned beetle and gypsy moths). White-tailed deer thrive in fragmented non-urban areas and the resulting over-browse of the forest system in this landscape is severe and virtually eliminates forest regeneration. White-tailed deer also selectively browse giving invasive species that they avoid (barberry species, etc) a stronghold in our forested understory. Although more prevalent in the coastal region, predatory laughing gulls, herring gulls, and great black-backed gulls may impact breeding populations of birds, reptiles, and amphibians in this zone.

Stream encroachment is the leading cause of degradation of riparian ecosystems including habitat loss, increased water temperatures and runoff of contaminants. Invasive plants, such as common reed or *Phragmites* (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*), severely reduce suitability of wetlands for marsh-nesting birds. The sinuous network of riparian corridors in southern portion of this zone provides the only egress for wildlife to disperse through developed regions. Mute swans degrade wetlands throughout the area by grazing submerged aquatic vegetation. Furthermore mallards, which thrive in areas with human habitation, compete with and displace American black ducks and have also been known to hybridize with them, particularly in the northern part of this zone. In riparian areas, North American beavers can create wetland habitat suitable for many species by damming up streams, but may, in turn, alter riparian habitat downstream from the dam.

Many forest and grassland species are area sensitive and their populations decline as habitat size decreases. Mowing/brush-hogging of fields, roadsides and utility rights-of-way during breeding season (mid-April through early July) increases mortality and reduces productivity of many species, including birds, reptiles and amphibians, invertebrates, and small mammals. Additionally, the impact of free-ranging domestic and feral cats on wildlife is well documented and can severely impact and destroy important urban wildlife populations. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Identify, protect, enhance and/or restore endangered, threatened and special concern wildlife populations and their habitats through full implementation of Landscape Project.
- Identify, protect, enhance and/or restore suitable wetland/riparian habitat for bald eagle, ospreys, least terns, pied-billed grebes, northern harriers, night-herons, and other wetland species of conservation concern.
- Identify, protect, enhance and/or restore large tracts of suitable forest and forested wetland habitat for area-sensitive forest species of conservation concern, particularly for red-shouldered hawks, barred owls, and forest passerines.
- Identify, protect, enhance and/or restore suitable open-field/grassland habitat for area-sensitive grassland species such as upland sandpipers, savannah sparrows, and grasshopper sparrows and American burying beetles.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Inventory, determine distribution, and monitor all endangered, threatened, special concern species in the Raritan Bay and North Atlantic Coast zone.
- Prevent and reverse declines of wildlife populations of reptiles and amphibians, birds, and butterfly and moth species of conservation concern and of rare fish species.
- Assess large-scale habitat change (every five to 10 years).
- Prevent illegal collection of rare reptiles and amphibian (including bog and wood turtles).
- Protect and enhance important and unique natural communities.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Protect water quality and the availability of wetland habitats.
- Promote public awareness and conservation, and participation in habitat restoration efforts on private land.
- Preserve populations of endangered, threatened, and special concern fishes by protecting water quality in occupied waterways.
- Protect, maintain, and/or enhance critical habitats to preserve populations of endangered, threatened, and special concern fish species.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Promote public education and increase awareness of New Jersey's indigenous nongame fish species.

e. Conservation Actions

Priority	Conservation Actions
Protect wildlife through implementation of Landscape Project mapping	
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)
1°	Identify and acquire data in areas where species data and monitoring gaps exist. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Perform critical habitat change analysis every five years to monitor trend in habitat change/loss. (<i>Protect habitat – Landscape Project</i>)

Priority	Conservation Actions (continued)
1°	Preserve endangered and threatened fish by protecting water quality and seeking possible Category 1 antidegradation designations in waterbodies where listed or special concern species occur. (<i>Protect habitat – fish</i>)
1°	Protect fish habitat using concentrated field sampling for listed or special concern species at areas indicated by FishTrack Database queries. (<i>Protect habitat – fish; Monitor wildlife – fish</i>)
1°	Plot distributions of special concern fish species. (<i>Protect habitat – fish</i>)
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available. (<i>Protect habitat – Landscape Project</i>)
Protect suitable wetland/riparian habitat for wildlife species of conservation concern	
1°	Maintain and enhance forested riparian areas and larger forest tracts for breeding bald eagles, forest raptors, songbirds, reptiles and amphibians, and terrestrial and aquatic invertebrates. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Maintain and enhance coastal and riparian emergent wetlands for breeding and foraging osprey, colonial waterbirds and marsh-nesting birds (yellow- and black-crowned night-herons, northern harriers, pied-billed grebes, rails). (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Maintain and enhance riparian buffer areas through stream bank stabilization, erosion control, native plantings, and fencing for songbirds, raptors, long-legged wading birds, riparian reptiles and amphibians, and invertebrates. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Identify and maintain wetlands with snags of dead trees for red-headed woodpecker and other cavity-nesters. (<i>Protect habitat – Landscape Project; Silviculture – land management</i>)
1°	Preserve and protect occupied and potential habitat for black rails and sedge wren; restrict human activity from nesting sites; preserve surrounding wetlands. (<i>Protect habitat – development, humans; Enhance habitat – private lands</i>)
1°	Preserve all large (> 4.9 hectares, 12.1 acres) freshwater wetlands from development, draining, and other forms of habitat loss. (<i>Protect habitat – development, humans</i>)
1°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulations database and Landscape Project (<i>Protect habitat – Landscape Project</i>)
1°	Since emergent wetlands such as the Meadowlands serve as source habitats, develop and implement proactive habitat management/conservation plans for colonial waterbirds that focus on habitat protection and restoration and population recovery. (<i>Protect habitat – development; Conserve wildlife – development</i>)
Protect suitable forest and forested wetland habitat for wildlife species of conservation concern	
1°	Enhance and restore forest on permanently protected natural lands and surrounding private lands through incentive programs. (<i>Silviculture – land management; Enhance habitat – private lands</i>)

1

Priority	Conservation Actions (continued)
1°	Protect and enhance forested areas for area-sensitive forest songbirds. Preserve forests with ≥ 10 hectares or 24.7 acres forest core area (area of forest >90 meters or 98.4 yards from the forest edge) especially forests that are not near major highways; avoid activities that cause breaks in the forest canopy and lead to fragmentation (roads, development), avoid forestry practices that reduce forest age and vegetative structure (clear-cutting, even-age stand management). (<i>Protect habitat – Landscape Project; Silviculture – land management</i>)
1°	Manage forests for larger, more mature woodlands with large trees for cavity-nesters and with a canopy closure of $> 80\%$. Maintain and enhance floodplain forests for area-sensitive forest passerines, and manage forest habitats for woodland raptor suitability. Old-growth forested wetlands must be preserved for barred owls and red-shouldered hawks. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. (<i>Silviculture – land management</i>)
1°	Maintain and/or restore forested habitat corridors connecting patches of forest. (<i>Corridors – sprawl</i>)
1°	Select and manage woodlots to maintain dead trees, reduce understory, and thin tree stands for open-woodland species and cavity-nesters such as red-headed woodpeckers and nightjars. (<i>Silviculture – land management; Conserve wildlife – rare wildlife</i>)
1°	Identify, protect, and maintain coniferous and hemlock forests with $>70\%$ forest cover for priority bird species (black-throated green warbler, northern parula), reptiles and amphibians. (<i>Protect habitat – Landscape Project,)</i>
2°	Study songbird migration and develop appropriate management strategies for important stopover areas including collaboration with surrounding private landowners. (<i>Protect habitat – migratory birds</i>)
Protect suitable grassland habitat for wildlife species of conservation concern	
1°	Identify and enhance existing grasslands important for endangered, threatened, and special concern species; enhance large grasslands with potential to support a robust grassland community. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Collaborate with municipal landfill operations to promote planting and management of capped landfills for grassland-dependent species. (<i>Education – humans</i>)
1°	Maintain and enhance grasslands and early-successional habitats where they exist; do not expand or create grassland and early-successional habitat at the expense of large forest tracts and forested riparian areas. (<i>Protect habitat – development; Enhance habitat – private lands</i>)

1

Priority	Conservation Actions (continued)
1°	Identify areas where scrub-shrub habitat can be created and/or maintained with little impact to forested, wetland, and grassland habitats to maintain populations of butterflies and moths, reptiles, amphibians, and scrub-shrub birds such as American woodcock and northern bobwhite quail. (<i>Protect habitat – Landscape Project</i>)
1°	Develop best management practices (BMPs) for utility rights-of-way (ROWs) to reduce impacts of vegetation management practices on wildlife and enhance early-successional habitats. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Identify areas where invasive, non-indigenous plants and animals are either already established or are becoming established through surveys and public participation. Prioritize areas for control measures. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the Asian longhorned beetle and gypsy moth. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. (<i>Conserve wildlife – deer; Evaluate restoration – deer</i>)
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife – deer; Evaluate restoration – deer</i>)
1°	Continue or develop, implement and evaluate methods for both aquatic and terrestrial invasive species removal programs. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
2°	Request permission from private landowners (both those who allow hunting and do not allow hunting) to establish vegetation monitoring plots. This will allow greater surveillance of deer impacts on private lands, provide landowners direct information about the health of their land, and provide greater data input into the deer harvest formula. (<i>Evaluate restoration – deer</i>)

1

Priority	Conservation Actions (continued)
Inventory wildlife of conservation concern	
1°	Systematically survey the Raritan Bay zone, particularly airports, Liberty, Cheesequake, and Allaire state parks, Earl Naval Base, Manasquan River WMA, Colts Neck, Wall, Middletown, and Tinton Falls for American burying beetle, songbirds, raptors, colonial waterbirds, grassland/open-field butterflies and moths, and wetland butterflies and moths. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Promote coordination of species monitoring and management efforts among conservation groups and state agencies in New Jersey.
1°	Identify and survey suitable habitat for northern spring salamanders, northern copperheads, and checkered whites. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Research survey methods and develop a plan for the survey and long-term monitoring of colonial waterbird populations on the Raritan Bay coast and songbird populations throughout the zone. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
2°	Survey all salt marshes for breeding seaside and saltmarsh sharp-tailed sparrows. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
Prevent and reverse declines of wildlife and rare fish populations	
1°	Work with managers to manage impoundments to benefit bitterns, rails, ducks and some invertebrates by providing suitable foraging habitat and encouraging dense stands of emergent vegetation for nesting. (<i>Protect habitat – humans</i>)
1°	Conduct surveys to find more information about the species and management requirements of rails and other secretive marsh nesting species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Actively protect, monitor, and manage bald eagle nests and foraging areas, including posting signs in waterways to prevent disturbance by recreational water-users and cooperation with private landowners. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
1°	Manage freshwater wetlands for pied-billed grebes and other wetland breeding species: create impoundments, maintain stable water levels during nesting season, restrict recreational activity, and monitor contaminant levels. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
1°	Determine habitat needs, limiting factors, and contaminant burdens in wintering greater and lesser scaup and sea ducks of conservation concern. (<i>Conserve wildlife – game species</i>)
1°	Continue to monitor reproductive success of peregrine falcons and northern harriers and protect nesting areas from human disturbance. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)

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Priority	Conservation Actions (continued)
1°	Protect all remaining habitat for saltmarsh sharp-tailed sparrows (high marsh with buffer, stable water levels) and identify areas for restoration of snowy egret, saltmarsh sharp-tailed sparrow, seaside sparrow, and rail populations. (<i>Protect habitat – Landscape Project</i>)
1°	Assess impacts of coastal and offshore wind turbines on breeding, migrating, and wintering bird and bat populations. (<i>Protect habitat - humans</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect aquatic wildlife-humans</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Monitor wildlife – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Monitor wildlife – fish</i>)
2°	Study how land use practices such as ditching, impounding, dredging, open marsh water management, burning, and marsh restoration impact species in this suite. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
2°	Research effects of parasites and diseases on special concern fish species' populations. (<i>Monitor wildlife – fish</i>)
2°	DFW to give priority attention to species of greatest conservation need in planning or implementing any response to any exotic pathogen introduction or incident. (<i>Conserve wildlife – invasives, rare wildlife</i>)
Assess large-scale habitat change every five years	
1°	Collaborate with NJ DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years.
Prevent illegal collection of reptiles and amphibians	
1°	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
2°	Recruit and educate local law enforcement of endangered species laws. Develop a partnership between them and the NJ Division of Fish and Wildlife's Bureau of Law Enforcement to enforce protection of native wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
Protect and enhance important and unique habitats	
1°	Work with state agencies and local governments to map significant natural communities in the Raritan Bay and North Atlantic Coast. (<i>Protect habitat – Landscape Project</i>)

1

Priority	Conservation Actions (continued)
1°	Identify, protect, and enhance critical migratory stopover habitats such as the Atlantic Highlands (Holmdel, Middletown Hazlet), Manasquan Naval Depot (Colts Neck, Tinton Falls), and Tom's River (Brick, Wall). (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Work with local governments and NJ DEP's Natural Heritage Program (NHP) to protect and enhance the pine barren upland/wetland complex and rare plant species at Shark River Station. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic, colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat - humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding the importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Protect water quality and maintain adequate buffers	
1°	Maintain larger buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat – Landscape Project</i>)
1°	Protect marshes from chemical contamination, siltation, eutrophication, and other forms of pollution/contamination that could directly harm wetland dependent species or their food supply. (<i>Conserve wildlife – contaminants</i>)
2°	Identify and research water quality parameters for bald eagle, wood turtle, and special concern amphibian populations. (<i>Conserve wildlife – rare wildlife</i>)
Promote public education and awareness and wildlife conservation	
1°	Engage landowners in protection efforts for endangered species. (<i>Conserve wildlife – rare wildlife; Education – humans</i>)

1

Priority	Conservation Actions (continued)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve them in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Educate public about keeping cats indoors; work to develop a statewide policy for local communities to discourage managed cat colonies and trap, neuter and release programs. (<i>Education – humans; Conserve wildlife – cats, subsidized predators</i>)
2°	Develop and maintain education materials and viewing opportunities for the public; educate public on threats to wildlife, and develop management guidelines for private landowners with significant bald eagle, wood turtle, freshwater wetland bird, grassland bird, woodland raptor, or scrub-shrub/open field bird populations. (<i>Conserve wildlife – rare wildlife; Education – humans</i>)
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
2°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. (<i>Education – humans</i>)
2°	Develop and maintain educational materials about nongame fish for dissemination to the public. (<i>Education – humans</i>)

2

3 f. Potential Partnerships to Deliver Conservation

4 Private Landowners

5 • Protect and enhance habitat through innovative partnerships with private landowners.

- 6 ○ Implement best management practices that protect nesting and foraging sites of bald
- 7 eagle, forest passerine, freshwater wetland bird, raptor, and scrub-shrub/grassland
- 8 bird populations.
- 9 ○ Collaborate with conservation groups to utilize existing wildlife incentive programs
- 10 to aid private landowners in habitat restoration.
- 11 ○ Utilize incentive programs that encourage the management of bog turtle, other
- 12 priority species and grassland dependent species populations.
- 13 ○ Target private landowners surrounding public natural lands to manage land for
- 14 mature forest in order to increase effective size and connectivity of forest patches.
- 15 ○ Encourage farmers to preserve farmland through conservation easements or Transfer
- 16 of Development Rights (TDRs) through partnerships with NJ DEP's Green Acres
- 17 Program, The Nature Conservancy – NJ Chapter, SADC, NJ Farm Bureau, local land
- 18 trusts, and local municipalities for the conservation of bog turtle, forest and grassland
- 19 bird populations.

- Develop/maintain cooperative relationships with private landowners with bog turtles and breeding bald eagles and freshwater wetland birds on their land.
- Develop/maintain cooperative relationships with Newark, Allaire, and Hop Brook Farm airports to encourage the management of grasslands for species of conservation concern.
- Encourage landowners to allow afforestation of riparian zones through incentive programs
- Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
- Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
- Work with landowners to maintain/enhance existing habitats where listed and special concern fish species occur.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter, Conserve Wildlife Foundation, and NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
 - Involve Citizen Scientists in management projects and protection projects, such as protection and posting of bald eagle nesting areas.
 - Continue volunteer-based summer bat concentration surveys.
- Collaborate with NJ Audubon Society, NY/NJ Baykeeper, Raritan Riverkeeper, State Parks, and other conservation organizations to educate public on the impacts of free-ranging domestic cats and feral cats and other threats on wildlife species of conservation concern.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds.
- Promote backyard habitat management for invertebrates, reptiles, amphibians, migratory raptors and passerines.
- Work with landowners to maintain/enhance existing habitats where listed special concern species occur.

Conservation Organizations

- Partner with NY/NJ Baykeeper, Raritan Riverkeeper, NJ Conservation Foundation, NJ Audubon Society, The Nature Conservancy – NJ Chapter, and other conservation organizations to protect and enhance habitats.
 - Develop a long-term coordinated monitoring and data-sharing project for colonial waterbirds and songbirds.
 - Protect bald eagles, ospreys, peregrine falcons, and woodland raptor nesting and foraging sites.
 - Protect emergent wetlands and open water for American bitterns, pied-billed grebes, sedge wrens, colonial waterbirds, and other marsh birds of concern
 - Initiate and support eradication efforts for invasive plant species
 - Create wildlife viewing opportunities.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
 - Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.
- Develop effective and coordinated monitoring and data-sharing methods with conservation groups to fill data gaps and enable new species data to be incorporated into Landscape Project and the Biotics database.
- Collaborate with NJ Audubon Society on designating Important Bird Areas and fill gaps in baseline data.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds.
- Encourage the use of priority habitat maps to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC), Farm Bureau for Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.

Wildlife Professionals

- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USDA's Natural Resource Conservation Service (NRCS), USFWS - NJ Field Office, and the DCA, Office of Smart Growth to protect, enhance, and create habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to work with the DEP's Land Use Regulation Program to protect and appropriately classify wetlands for spotted turtles.
 - DFW, conservation organizations, and land stewards to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, and invertebrates with Division of Watershed Management and Division of Fish and

- 1 Wildlife. Partner with them to investigate water quality and threats of
- 2 contaminants/pollution.
- 3 ○ DFW to work with the DEP's Division of Parks and Forestry (NJDPF) to enhance
- 4 state forests for wildlife: uneven-age stand management, preserve standing and fallen
- 5 dead biomass, manage for older-growth forests especially wetland forests and
- 6 adjacent upland forest.
- 7 ○ DFW to share site information and expertise with state and federal law enforcement
- 8 to increase surveillance at sensitive bald eagle and bog turtle sites.
- 9 ○ Work with DEP's Water Monitoring and Standards to recommend classification
- 10 upgrades in water bodies where listed or special concern species occur.
- 11 ○ DFW to work with neighboring state fish and wildlife agencies to radio-track
- 12 dispersing Indiana bats across state boundaries.
- 13 ○ DFW to work with state and county mosquito commissions to reduce the use of
- 14 deleterious insecticides and biological controls at known amphibian breeding sites.
- 15 ○ DFW to coordinate with the Department of Transportation to reduce road mortality to
- 16 reptiles and amphibians and large mammals by creating wildlife under- and
- 17 overpasses on new roads and road upgrades.
- 18 ○ DFW to lead in the development of specific conservation plans for special concern
- 19 birds, reptiles and amphibians, and invertebrates on state lands.
- 20 ○ Expand efforts to create habitat and implement best management practices that
- 21 protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and
- 22 other forest dwelling species on state lands and with natural resource managers,
- 23 county and municipal utility authorities and planners; and where grassland/ scrub-
- 24 shrub habitats already exist, enhance and maintain habitats for grassland and scrub-
- 25 shrub/open field birds.
- 26 ○ DFW will integrate results of research on vegetative structure in response to deer
- 27 densities into deer management strategies within deer management zones.
- 28 ○ DFW to work with land management agencies at the state, local, and federal levels to
- 29 implement deer management plans and harvest quotas that achieve desired deer
- 30 densities to maintain ecological integrity of natural communities.
- 31 ○ DFW to work with USFWS and other state and federal partners to implement North
- 32 American Waterfowl Management Plan as appropriate.
- 33 ○ DFW to work with land stewards, private landowners, and municipal, state and
- 34 federal staff to establish best management practices in areas where listed or special
- 35 concern species occur.
- 36 ○ DFW to identify areas where scrub-shrub macro-sites can be created and/or
- 37 maintained for American woodcocks and northern bobwhite quail without negatively
- 38 affecting endangered, threatened, or special concern species and their habitats.
- 39 ○ DFW and DEP's Division of Parks and Forestry (DPF) to work with the USFWS and
- 40 National Park Service to develop effective plans to eradicate invasive, non-
- 41 indigenous plants on federal and state lands and aquatic systems that are threatening
- 42 critical wildlife habitats.
- 43 ○ DFW to work with USDA through NRCS and the WHIP program to control purple
- 44 loosestrife and other invasive plants in critical wildlife habitats.

- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.
- DFW to work with DEP's Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- Develop effective and coordinated monitoring and data-sharing methods with Allaire, Cheesequake, and Liberty state parks, Earl Naval Base, DFW, and watershed management areas to fill data gaps and enable new species data to be incorporated into Landscape Project and the Biotics database.
- DFW to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, USFWS, and US Department of Agriculture to continue monitoring diseases that can potentially affect wild, native populations of special concern fish species.
- DFW to continue working with fishing clubs and organizations, lake communities, hatcheries nationwide, and individuals permitted to stock fish in NJ's freshwater streams and lakes to ensure healthy stock is used to minimize the spread of disease and parasites to native fish species and to prevent the use or release of exotic species.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and colonial waterbird viewing opportunities.
- DFW to lead in the development of educational materials for public and private landowners about wildlife of greatest conservation need and associated habitats.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Incorporate standardized monitoring protocols, measures of success, and timeline for monitoring activities into mitigation projects and habitat conservation plans.
- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts on private and public land.
- Annually monitor abundance, productivity, distribution, and trends of ospreys (biannually), bald eagles and colonial waterbirds.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, the Vernal Pool Project, and the volunteer coverboard surveys.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Conduct long-term monitoring of vegetative plots (exclosures) within state lands to assess vegetative success/ failure of deer management strategies over time as deer densities change.

- 1 • Continue monitoring diseases as outlined in the DFW's annual Fish Health Management
2 Plan.
3
4

3. Central Piedmont Plains

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

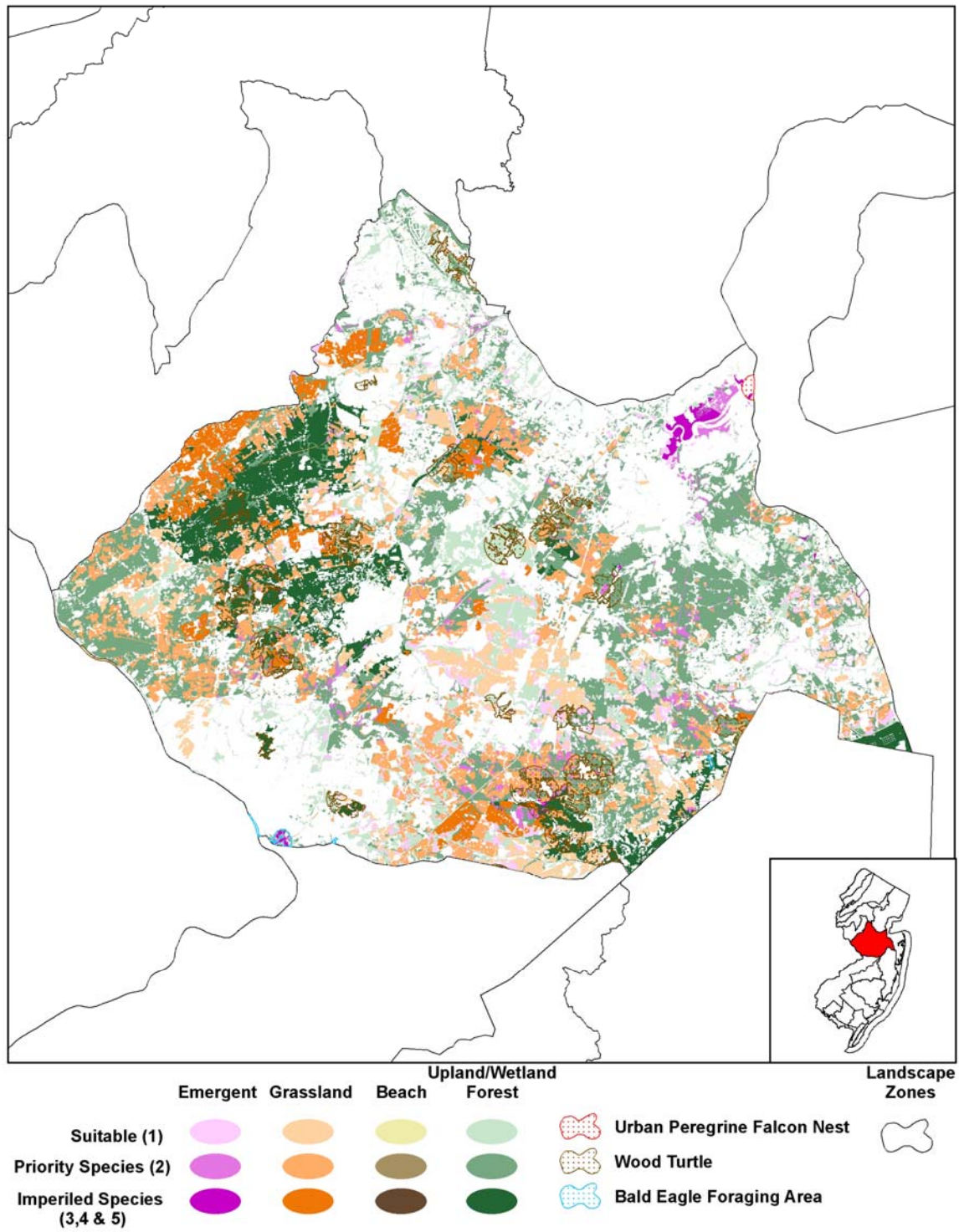
The second largest zone in the state, the Central Piedmont Plains zone (Figure 20) lies at the “waistline” of New Jersey, consisting of Mercer County, southern portions of Somerset and Middlesex counties and western Monmouth County (west of Highway 34). This region includes the Assunpink Wildlife Management Area (WMA), Delaware & Raritan Canal and Six Mile Run, Sourland Mountain Preserve, and Pigeon Swamp State Park and Forest.

Extensive farmed areas and grasslands, fragmented woodlands, tidal freshwater marshes, and housing developments characterize the Central Piedmont Plain, and about half of the entire area is considered suitable for wildlife of concern. Large agricultural/grassland complexes span this zone along the Mercer-Middlesex border south to Assunpink WMA and includes cropland, pasture, and agricultural wetlands. The Sourland Mountain Preserve, Assunpink WMA, and Pigeon Swamp State Park and Forest contain sizeable deciduous forest tracts. The largest wetlands in this zone occur east of the Delaware & Raritan Canal State Park.

This zone is unique because it is a transition area between the hardwood forests of northern New Jersey and the deciduous-coniferous forests of the Pinelands. Preserving connectivity of terrestrial and riparian habitats is a primary goal here.

Forest patches (upland, wetland and riparian) totaling approximately 67,500 hectares (260.6 square miles) in the Central Piedmont Plains, range in size from 0.2 hectare (half an acre) to over 7,000 hectares (27 square miles) (Sourland Mountain Preserve), and are a high-priority habitat type in this landscape. Over 36,000 hectares (138.9 square miles) of early-succession habitat (grasslands, old fields, agriculture), with patch sizes ranging from half an acre to nearly 2,000 hectares (7.7 square miles) (East Amwell Township), provide habitat for all of New Jersey’s endangered and threatened grassland birds. Most of these areas are agricultural lands, but there are also 11 airports that provide grassland habitat for species of conservation concern. Approximately 8,500 hectares (32.8 square miles) of emergent wetlands exist in the Central Piedmont Plains. Most of these areas are small pockets of scattered wetlands, but larger expanses exist along the Raritan River estuary and in Assunpink WMA.

1 **Figure 20.** Critical landscape habitats within the Central Piedmont Plains conservation zone, as
 2 identified through the Landscape Map (v2).



b. Wildlife of Greatest Conservation Need

The Central Piedmont Plains supports one federal endangered and one federal threatened species, nine state endangered species, 17 state threatened species, 69 special concern and regional priority species, and seven additional harvested species of regional priority. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, are known to occur in the Central Piedmont Plains.

The largest forests in the north (Sourland Mountain, forests in the Stony Brook-Millstone Watershed Management Area) support area-sensitive species including the barred owl, bobcat, Cooper's hawk, and a large variety of forest-interior songbirds and forest reptiles and amphibians (wood turtle, northern copperhead, and vernal pool species). Forests in the south also support the barred owl and pinelands species (Pine Barrens treefrog, timber rattlesnake). Forests in both the north and south provide suitable habitat for summer populations of Indiana and other forest-dwelling bat species. Riparian forests (upland and wetland) spanning the zone support a sizeable population of wood turtles and a variety of special concern reptiles and amphibians. The Delaware & Raritan Canal State Park is an important greenway providing breeding and stopover habitat for migratory songbirds.

The large complexes of grasslands within the agricultural matrix in this zone present great management opportunities and currently support area-sensitive grassland species (upland sandpiper, vesper, savannah and grasshopper sparrows, bobolink). Grassland-dependent invertebrates such as pink streak and scarlet bluet are also found in this zone. Many of these areas also provide breeding habitat for scrub-shrub birds, bog turtles, frosted elfin, and basking and nesting areas for wood turtles and eastern box turtles. American kestrels appear to have declined dramatically in this and other agricultural regions of the state, and large complexes of agricultural land provide opportunities to restore populations through a nest-box program.

The diverse wetland, lacustrine (lake), and riverine habitats support colonial waterbirds (greenand great blue herons, and black-crowned night-heron), other freshwater wetland birds (pied-billed grebes, common loons), bog turtles, spotted turtles, carpenter frogs, Fowler's toads, Pine Barrens treefrogs, freshwater mussels, and silver-bordered fritillaries. Cliff swallows, chimney swifts, and concentrations of summer bats, including Indiana bats, can breed in highly urbanized areas and utilize man-made structures for nesting habitat. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Central Piedmont Plains

Table PP24. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Reptiles				
Bog turtle		X		X
Mussels				
Dwarf wedgemussel	X***			
Fish				
Shortnose sturgeon	X			

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

***Riverine habitat.

X: Species occurs within the identified habitat.

Table PP25. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat		X		X
Birds				
American bittern		X		X
Northern harrier		X	X	
Peregrine falcon				X
Pied-billed grebe		X		
Red-shouldered hawk				X
Upland sandpiper			X	
Vesper sparrow			X	
Reptiles				
Timber rattlesnake				X
Amphibians				
Blue-spotted salamander		R		R

R: Proposed reintroduction of species

X: Species occurs within the identified habitat.

Table PP26. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred Owl				X
Black-crowned night-heron		X		
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl			X	X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle				X
Amphibians				
Eastern mud salamander				X
Long-tailed salamander		X		X
Pine Barrens treefrog		X		X
Mussels				
Tidewater mucket	X			
Triangle Floater	X			
Yellow lampmussel	X			

State Threatened Species (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Insects				
Frosted elfin		X	X	X
Silver-bordered fritillary		X	X	X

X: Species occurs within the identified habitat.

Table PP27. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed myotis				X**
Eastern red bat				X**
Hoary bat				X**
Marsh rice rat			X	
Silver-haired bat				X**
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American golden-plover			X	
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Black-throated blue warbler				X
Black-throated green warbler				X
Blue-winged warbler		X		X
Broad-winged hawk				X
Brown thrasher				X
Canada warbler				X
Cerulean warbler				X
Chimney swift				X
Chuck-will's-widow				X
Cliff swallow		X	X	
Common nighthawk			X	X
Dickcissel			X	
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		X
Hooded warbler				X
Horned lark			X	
Indigo bunting			X	X
Kentucky warbler				X
Least bittern		X		
Least flycatcher				X
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Rose-breasted grosbeak				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Sharp-shinned hawk				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Spotted sandpiper		X		
Summer tanager				X
Veery				X
Whip-poor-will				X
Willet		X		
Willow flycatcher				X
Winter wren				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle			X	X
Northern copperhead				X
Northern diamondback terrapin		X		
Spotted turtle		X		X
Amphibians				
Carpenter frog		X		X
Fowler's toad		X		X
Mussels				
Creeper	X			X
Insects				
Clubtail dragonfly, <i>Gomphus septima</i>	X			X
Scarlet bluet, <i>Enallagma pictum</i>	X	X	X	
Pink streak, <i>Faronta rubripennis</i>				X
Fish				
American brook lamprey*	X			
Atlantic sturgeon	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy - NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table PP28. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		X
American woodcock				X
Canada goose (Atlantic population)	X	X		
Northern bobwhite			X	
Surf scoter	X			
Virginia rail		X		
Wood duck				X

X: Species occurs within the identified habitat.

Table PP29. Fish Species

Common Name	Water
Fish	
Hickory shad	X
Margined madtom	X
Shield darter	X

X: Species occurs within the identified habitat.

Table PP30. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to Wildlife and Habitats of the Central Piedmont Plains

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

While some forest, grassland, and wetland habitats are preserved in county, municipal, state, and federal lands, a large portion of these habitats are in danger of being lost to development pressures. Expanding development adjoins wetland habitat, removing upland buffers, and converts forests and farmlands into large homes with neatly trimmed lawns. Fragmentation of forest tracts, wetlands, and grasslands are also significant threats to wildlife. Many raptors and forest and grassland songbirds are area-sensitive and require areas of minimum size to establish territories and reproduce successfully. Fragmentation of habitat allows for many invasive plant species to become integrated into natural areas thereby degrading habitat suitability for many species. Additionally, fragmentation increases stress on the remaining trees, thereby increasing susceptibility of invasive pests (such as Asian longhorned beetle and gypsy moths). White-tailed deer thrive in fragmented non-urban areas and the resulting over-browse of the forest system in this landscape is severe and virtually eliminates forest regeneration. White-tailed deer also selectively browse giving invasive species that they avoid (barberry species, etc.) a stronghold in the forested understory.

Upland and wetland forest are high priority habitats in New Jersey because they are difficult to retain as mature, unbroken tracts and take many years to develop complex "old growth" structure. Most of the open fields in this zone are in the form of agriculture. Mechanized, row-crop agriculture renders agricultural lands unsuitable for most wildlife; mowing of cool-season grasses and along roadsides and utility rights-of-way during breeding season (mid-April through early July) increases mortality and reduces productivity of many species, including reptiles and amphibians, and small mammals, but especially birds and invertebrates.

Invasive plants, such as common reed or *Phragmites* (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*), can severely reduce habitat suitability of freshwater wetlands for marsh-nesting birds. Furthermore mallards, which thrive in areas with human habitation, compete with and displace American black ducks and have also been known to hybridize with them. American black ducks are not very prevalent within this zone, but do occur near Van Nest WMA and the Raritan River. In riparian areas, North American beavers can create wetland habitat suitable for many species by damming up streams, but may, in turn, alter riparian habitat downstream from the dam.

Other threats to species in the Central Piedmont Plains include pesticides, herbicides, and traffic noise. Additionally, the impact of free-ranging domestic and feral cats on wildlife is well documented and can severely impact and destroy important wildlife populations. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect endangered, threatened, and special concern wildlife populations and their habitats through full implementation of Landscape Project.
- Identify, protect, enhance, and/or restore suitable forest and wetland forest habitat for wildlife species of conservation concern, particularly for the barred owl, red-shouldered hawk, bobcat, timber rattlesnake, long-eared owl, forest passerines, and frosted elfin.
- Identify, protect, enhance, and/or restore suitable grassland and open-field habitat for wildlife species of conservation concern, particularly for the upland sandpiper, vesper sparrow, grasshopper sparrow, bobolink, savannah sparrow, pink streak and scarlet bluet.
- Identify, protect, enhance, and/or restore suitable wetland and riparian habitat for wildlife species of conservation concern, particularly for the osprey, northern harrier, American bittern, pied-billed grebe, silver-bordered fritillary, and clubtail dragonfly.
- Protect, maintain, and/or enhance critical aquatic habitats to preserve populations of endangered, threatened, and special concern fish species.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Inventory, determine distribution, and monitor all endangered, threatened, special concern wildlife and fish species in the Central Piedmont Plains.
- Prevent, stabilize, and reverse declines of forest raptors and songbirds, freshwater wetland birds, grassland and early-succession birds, open field birds as well as priority reptiles, amphibians, mussels, butterflies, dragonflies, damselflies, and rare fish species.
- Assess large-scale habitat change every five years
- Prevent illegal collection of rare reptiles and amphibian (including bog and wood turtles, timber rattlesnake and pine snake).
- Protect and enhance important and unique natural communities.
- Identify and protect summer roosting habitat for Indiana bats and other forest-dwelling bat species.
- Protect water quality and the availability of wetland habitats.
- Promote public education and awareness and wildlife conservation, and participation in habitat restoration efforts on private land
- Preserve populations of endangered, threatened, and special concern fishes by protecting water quality in occupied waterways.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Promote public education and increase awareness of New Jersey’s indigenous nongame fish species

1 e. Conservation Actions

Priority	Conservation Actions
Protect wildlife through implementation of Landscape Project mapping	
1°	Provide technical assistance and promote use of Landscape Project mapping in state land-use regulation, municipal planning, and land acquisition priorities. <i>(Protect habitat – Landscape Project)</i>
1°	Use baseline data to develop management strategies for endangered, threatened and special concern wildlife on permanently protected natural lands. <i>(Conserve wildlife – rare wildlife)</i>
1°	Perform critical habitat change analysis every five years to monitor trend in habitat change/loss. <i>(Protect habitat – Landscape Project)</i>
1°	Enhance and restore critical habitats through afforestation and revegetation where possible (forest and riparian habitats) and through active management (grasslands, wetlands, and early-successional habitats). <i>(Protect habitat – Landscape Project; Enhance habitat – private lands)</i>
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. <i>(Protect habitat – Landscape Project, migratory birds)</i>
1°	Identify and acquire data in areas where species data and monitoring gaps exist. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Protect habitat for endangered and threatened fish by protecting water quality and seeking possible Category 1 antidegradation designations in waterbodies where listed or special concern species occur. <i>(Protect habitat – fish)</i>
1°	Protect habitat for endangered and threatened fish by using concentrated field sampling for listed or special concern species at areas indicated by FishTrack Database queries. <i>(Monitor wildlife – fish; Protect habitat – fish)</i>
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. <i>(Protect habitat – Landscape Project)</i>
1°	Review and improve Landscape Project species habitat models as new land use/land cover data and data on species habitat requirements are available. <i>(Protect habitat – Landscape Project)</i>
Protect suitable forest and wetland forest habitat for wildlife	
1°	Maintain and enhance large forest tracts for viable populations of red-shouldered hawk, barred owl, bobcat, timber rattlesnake, long-eared owl, and forest-interior songbirds. <i>(Protect habitat – Landscape Project; Silviculture – land management)</i>
1°	Manage forests for larger, more mature woodlands with large trees for cavity-nesters and with a canopy closure of > 80%. Maintain and enhance floodplain forests for area-sensitive forest passerines, and manage forest habitats for woodland raptor suitability. Old-growth forested wetlands must be preserved for barred owls and red-shouldered hawks. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. <i>(Protect habitat – development; Silviculture – land management)</i>

1

Priority	Conservation Actions (continued)
1°	Act to protect and enhance forests areas for area-sensitive forest songbirds. Preserve forests with ≥ 10 hectares or 24.7 acres forest core area (area of forest >90 meters or 98.4 yards from the forest edge) especially forests that are not near major highways; avoid activities that cause breaks in the forest canopy and lead to fragmentation (roads, development), avoid forestry practices that reduce forest age and vegetative structure (clear-cutting, even-age stand management). (<i>Protect habitat – Landscape Project</i>)
1°	Identify, protect, and maintain coniferous and hemlock forests with $>70\%$ forest cover for priority bird species (black-throated green warbler, blue-headed vireo, northern parula), reptiles and amphibians. (<i>Protect habitat – Landscape Project</i>)
1°	Enhance and restore habitat on permanently protected natural lands and surrounding private lands (landowner incentive programs): Public natural lands serve as conservation centers for forest species; surrounding landowners are enlisted to manage their land to increase overall habitat size and connectivity to other suitable habitats. (<i>Silviculture – land management; Enhance habitat – private lands</i>)
1°	Maintain and enhance floodplain forests for forest passerines. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Select and manage woodlots to maintain dead trees, reduce understory, and thin tree stands for open-woodland species and cavity-nesters such as red-headed woodpeckers. (<i>Silviculture – land management</i>)
1°	Select and manage woodlots to maintain structural forest diversity, esp. shrub understory for forest passerines (Kentucky warblers, Louisiana waterthrushes, wood thrushes) and priority reptiles, amphibians, and invertebrate species. (<i>Silviculture – land management</i>)
2°	Study songbird migration and develop appropriate management strategies for important stopover areas including collaboration with surrounding private landowners. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
Protect suitable grassland and open-field habitat for wildlife	
1°	Identify and protect large expanses of grasslands from development, succession, and mechanized agricultural practices. (<i>Protect habitat – Landscape Project, humans; Agriculture – land management</i>)
1°	Identify and enhance existing grasslands important for endangered, threatened and special concern species; enhance large grasslands with potential to support a robust grassland bird community. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop best management practices (BMPs) for utility rights-of-way (ROWs) to reduce impacts of vegetation management practices on wildlife and enhance early-successional habitats. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
2°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bog turtle, frosted elfin, silver-bordered fritillary, grassland bird, scrub-shrub/open field bird, and special concern reptile populations. (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
Protect suitable wetland/riparian habitat for wildlife species of conservation concern	
1°	Preserve and enhance riparian habitats to protect aquatic ecosystems for dwarf wedgemussels, tidewater mucklets, and shortnose sturgeon. (<i>Protect habitat – mussels, fish; Enhance habitat – private lands</i>)
1°	Assess impact of aquatic invasive species on freshwater mussels. Implement management strategy to eliminate aquatic invasive species in sensitive or important habitats containing listed freshwater mussels. (<i>Protect habitat – mussels; Conserve wildlife – invasives</i>)
1°	Maintain and enhance freshwater emergent wetlands for viable populations of pied-billed grebe, American bittern, black-crowned night-heron, silver-bordered fritillary, clubtail dragonfly and bog turtle. (<i>Protect habitat – development, sprawl; Enhance habitat – private lands</i>)
1°	Identify and maintain wetlands with snags of dead trees for red-headed woodpeckers and other cavity-nesters. (<i>Protect habitat – development, sprawl; Silviculture – land management</i>)
2°	Encourage widening of stream flow under roadways (using culverts or a more “natural” stream-like set-up (i.e. gravel bed with concrete sides). (<i>Corridors – roads; Protect habitat – roads</i>)
2°	Encourage stream bank restoration for freshwater mussels. (<i>Protect habitat – mussels</i>)
Protect suitable aquatic habitat for rare fish species	
1°	Protect water quality by seeking possible Category 1 antidegradation designations in waterbodies where listed or special concern species occur. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries’ FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Monitor wildlife – fish</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Identify areas where invasive, non-indigenous plants and animals are either already established or are becoming established through surveys and public participation. Prioritize areas for control measures. (<i>Conserve wildlife – invasives</i>)

1

Priority	Conservation Actions (continued)
1°	Work with public and private landowners to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the Asian longhorned beetle and gypsy moth. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. (<i>Evaluate restoration – deer; Conserve wildlife – deer</i>)
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Evaluate restoration – deer; Conserve wildlife - deer</i>)
2°	Request permission from private landowners (both those who allow hunting and do not allow hunting) to establish vegetation monitoring plots. This will allow greater surveillance of deer impacts on private lands, provide landowners direct information about the health of their land, and provide greater data input into the deer harvest formula. (<i>Evaluate restoration – deer</i>)
1°	Develop and implement, through regulations or legislation, programs that require farmers to achieve deer management goals, including harvest quotas, to obtain farm tax assessment or to qualify for farmland preservation programs. (<i>Conserve wildlife – deer</i>)
Inventory and monitor wildlife of conservation concern	
1°	Continue long-term monitoring for grassland birds, forest songbirds and raptors, reptiles and amphibians (Herptile Atlas and calling amphibian surveys), freshwater mussels and aquatic invertebrates (Integrated Aquatic Assessment). (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue coordinated wildlife monitoring and management efforts among conservation groups and state agencies in New Jersey (Citizen Scientist Project, cooperative management efforts on state and permanently-protected conservation lands and adjacent private lands). (<i>Monitor wildlife – long-term monitoring</i>)
1°	Repeat surveys for woodland raptors every four years. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
1°	Conduct searches for triangle floaters, frosted elfins, Henslow's sparrows, long-tailed salamanders, eastern mud salamanders, queen snakes, silver-bordered fritillaries, clubtail dragonflies, scarlet bluets, and pink streaks. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Survey suitable habitats to determine distribution of barn owls, American kestrels, northern copperheads, and other wildlife of greatest conservation need and establish baseline information for monitoring. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Identify and address data gaps in species monitoring, distribution, and management. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct demographic studies (productivity, survival, dispersal) of priority species to provide information needed for determining causes of population declines and understanding metapopulation dynamics. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Survey to collect baseline data and develop management strategies for endangered, threatened and special concern wildlife on permanently-protected natural lands. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Monitor wildlife – fish</i>)
2°	Identify threats to vernal pools and devise strategies to protect species dependent upon vernal pool habitat. (<i>conserve wildlife – rare wildlife</i>)
2°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
2°	Identify and research water quality parameters for spotted turtle, carpenter frog, and Fowler's toad populations. (<i>Conserve wildlife – rare wildlife</i>)
Prevent, stabilize, and reverse declines of wildlife and rare fish populations	
1°	Develop best management practices (BMPs) for utility rights-of-way (ROWs) to reduce impacts of vegetation management practices on wildlife and enhance early-successional habitats. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
1°	Investigate causes of decline and landscape-scale habitat requirements of American kestrels; identify most effective methods to restore and enhance habitat and provide nest cavities (standing dead biomass and nest boxes). (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
1°	Identify areas where scrub-shrub habitat can be created and/or maintained with little impact to forested, wetland, and grassland habitats to maintain populations of shrub-dependent butterflies and moths, reptiles, amphibians, and scrub-shrub birds such as the yellow-breasted chat, American woodcock, and northern bobwhite quail. (<i>Protect habitat – Landscape Project</i>)

1

Priority	Conservation Actions (continued)
1°	Identify and enhance grassland habitat for source populations of grassland birds and American kestrels. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Consider consolidation of adjacent grassland fields, through the elimination of hedgerows, fences, or tree lines, in areas where open land occupies a considerable amount of the surrounding landscape and grassland management can be identified as a reasonable management alternative. (<i>Agriculture – land management</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect aquatic wildlife – humans</i>)
2°	Determine if differences exist in grassland dependent species diversity and abundance in the Northeast between warm season and cool season grass types. (<i>Agriculture – land management</i>)
2°	Research different management techniques to understand the appropriateness of prescribed burning, mowing, and other methods for maintaining suitable habitat for northeastern grassland birds and grassland dependent invertebrates. (<i>Conserve wildlife – rare wildlife</i>)
2°	Reduce impact of road mortality to wildlife and identify areas with known wildlife mortality issues (breeding amphibians) and high densities of wildlife prone to road mortality (snakes, turtles, large mammals). (<i>Protect habitat – roads</i>)
2°	Work with managers to manage impoundments to benefit bitterns, rails, ducks and some invertebrates by providing suitable foraging habitat and encouraging dense stands of emergent vegetation for nesting. (<i>Protect habitat – humans</i>)
2°	Secure bog turtle and wood turtle populations threatened by collection; identify sources of funding for enforcement of endangered species laws and protection of wildlife from illegal collection. (<i>Protect wildlife – humans</i>)
2°	Research effects of parasites and diseases on populations of special concern fish species.’ (<i>Monitor wildlife – fish</i>)
2°	DFW to give priority attention to species of greatest conservation need in planning or implementing any response to any exotic pathogen introduction or incident. (<i>Conserve wildlife – rare wildlife, invasives</i>)
Assess large-scale habitat change every five years	
1°	Collaborate with NJ DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years.
1°	Perform critical habitat change analysis to assess trend in habitat loss and conversion. (<i>Protect habitat – Landscape Project</i>)
Prevent illegal collection of rare reptiles and amphibians	
1°	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)

1

Priority	Conservation Actions (continued)
2°	Recruit and educate local law enforcement of endangered species laws. Develop a partnership between them and the NJ Division of Fish and Wildlife's Bureau of Law Enforcement to enforce protection of native wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnake), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
Protect and enhance important and unique habitats	
1°	Work with state agencies and local governments to map significant natural communities in the Central Piedmont Plains. (<i>Protect habitat – Landscape Project</i>)
1°	Identify, protect, and enhance critical migratory stopover habitats such as Sourland Mountains, Princeton Woods, and Assunpink WMA. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Work with local governments and the NJ DEP's Natural Heritage Program (NHP) to protect and enhance the tidal freshwater swamp and sandy bluff natural community and rare plant species at the South River Marshes. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Work with local governments and NHP to protect and enhance the forest at Sourland Mountain Preserve. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Work with local governments and NHP to protect and enhance the open farmlands at East Amwell Grasslands Macrosite. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic, colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring;</i>)
1°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat - humans</i>)

1

Priority	Conservation Actions (continued)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). <i>(Protect habitat – Landscape Project; Conserve wildlife – rare wildlife)</i>
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). <i>(Conserve wildlife – rare wildlife)</i>
Protect water quality and maintain adequate buffers	
1°	Maintain larger buffers around wetlands, riparian and floodplain areas and minimize destruction. <i>(Protect habitat – Landscape Project)</i>
2°	Identify and research water quality parameters for bald eagle, wood turtle, and special concern amphibian populations. <i>(Conserve wildlife – rare wildlife)</i>
Promote public education and awareness and wildlife conservation	
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. <i>(Education – humans; Conserve wildlife – invasives)</i>
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. <i>(Education – humans; Conserve wildlife – invasives)</i>
1°	Engage landowners in protection efforts for endangered species through Citizen Science programs. <i>(Education – humans; Conserve wildlife – rare wildlife)</i>
1°	Educate public about keeping cats indoors; work to develop a statewide policy for local communities to discourage managed cat colonies and trap, neuter and release programs. <i>(Education – humans; Conserve wildlife – cats, subsidized predators)</i>
2°	Develop and maintain education materials and viewing opportunities for the public; educate public on threats to wildlife, and develop management guidelines for private landowners with significant bald eagle, wood turtle, freshwater wetland bird, grassland bird, woodland raptor, or scrub-shrub/open field bird populations. <i>(Education – humans; Enhance habitat – private lands)</i>
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. <i>(Education – humans)</i>
2°	Develop and maintain educational materials and viewing opportunities for the public consistent with species recovery goals. <i>(Education – humans)</i>
2°	Develop and maintain educational materials about nongame fish for dissemination to the public. <i>(Education – humans)</i>

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f. Potential partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of forest passerine, freshwater wetland bird, raptor, and scrub-shrub/open field bird populations.
 - Utilize incentive programs that encourage the management of bog turtle, forest and grassland bird populations.
 - Through incentive programs, target private landowners surrounding public natural lands to manage land for mature forest in order to increase effective size and connectivity of forest patches
 - Encourage farmers to preserve farmland through conservation easements and TDRs (Transfer of Development Rights) through partnerships with NJ DEP's Green Acres, the Nature Conservancy – NJ Chapter, NJ Farm Bureau, SADC, local land trust, and local municipalities for the conservation of bog turtle, forest and grassland bird populations.
 - Develop/maintain cooperative relationships with private landowners with bog turtles and breeding freshwater wetland birds on their land.
 - Collaborate with private landholders to manage grassland and early-succession complexes for source populations of grassland birds, invertebrates, yellow-breasted chats, and American kestrels.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
 - Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
 - Work with landowners to maintain/enhance existing habitats where listed and special concern fish species occur.
 - In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.

- Involve Citizen Scientists in conservation projects, such as stream bank restoration, and searching for undocumented freshwater wetland bird populations.
- Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas.
- Continue volunteer-based summer bat concentration surveys.
- Promote backyard habitat management for migratory raptors and passerines.
- Work with landowners to maintain/enhance existing habitats where listed special concern species occur.
- Educate landowners about the negative impact free-roaming housecats have on wildlife; discourage managed cat colonies and trap, neuter and release programs.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub birds and American kestrels.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with D&R Greenway, Stony Brook-Millstone Watershed, Sourland Mountain Preserve, NJ Audubon Society, NJ Conservation Foundation, The Nature Conservancy - NJ Chapter, and other conservation organizations to protect and enhance habitats.
 - Protect woodland raptor nesting and foraging sites.
 - Develop best management practices and conservation plans for grasslands and utility rights-of-way.
 - Protect and enhance riparian corridors and early-succession fields.
 - Encourage management of grassland and early-succession complexes for source populations of grassland birds, invertebrates, yellow-breasted chats, and American kestrels.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
 - Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.
- Consult with conservation organizations to develop educational programs, particularly the Keep Cats Indoors campaign.
- Establish data-sharing partnerships to ensure species data from other organizations' surveys are incorporated into the Landscape Project and Office of Natural Lands Management's Natural Heritage Biotics database.
- Encourage the use of priority habitat maps to guide land acquisition by conservation organizations through programs such as NJ DEP's Green Acres, State Agricultural Development Committee (SADC), NJ Farm Bureau, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other farm conservation programs.

- Work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands.
- Collaborate with Ducks Unlimited on studies involving migration and wintering ecology of waterfowl and other birds.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USDA's NRCS, USFWS - NJ Field Office, SADC, NJ Farm Bureau, and the DCA, Office of Smart Growth, to protect, enhance, and create habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) to protect woodland raptor nesting and foraging sites.
 - DFW to develop a plan to prevent collection of bog and wood turtles, and timber rattlesnakes and pine snakes, and to protect sensitive sites (basking, gestation/ nesting, hibernacula) from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.
 - DFW to determine groundwater recharge areas for bog turtle habitats with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality in these areas.
 - Work with DEP's Water Monitoring and Standards to recommend classification upgrades in water bodies where listed or special concern species occur.
 - DFW to work with DEP's Division of Parks and Forestry (DPF) to enhance state forests for wildlife: uneven-age stand management, preserve standing and fallen dead biomass, manage for older-growth forests especially wetland forests and adjacent upland forest, avoid forestry practices in wetland forests.
 - DFW and conservation organizations to encourage and provide site information to the NJ Department of Transportation to incorporate multiple culverts in road construction to widen stream flow for fish and wildlife passage and preserve natural streambeds and reduce road mortality by creating wildlife passages across roadways.
 - DFW, National Park Service, conservation organizations, and DEP's Lands Use Regulation Program (LURP) to work to protect and appropriately classify wetlands for special concern invertebrate, reptile, and amphibian populations on state, federal, and private lands.
 - DFW to lead in the development of specific conservation plans for special concern birds, reptiles, amphibians, and invertebrates on state lands.
 - DFW and DPF to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive, non-indigenous plants on federal and state lands and aquatic systems that are threatening critical wildlife habitats.
 - DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
 - DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
 - DFW to partner with local, county and state authorities to establish best management practices in areas where listed or special concern fish and wildlife species occur.

- DFW to work with LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and other forest dwelling species on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
- DFW, conservation organizations, and land stewards to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, and invertebrates with the DEP's Division of Watershed Management. Partner with them to investigate water quality and threats of contaminants/pollution.
- DFW to work with state and county mosquito commissions to reduce the use of deleterious insecticides and biological controls at known amphibian breeding sites.
- DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW and USDA-NRCS to collaborate with SADC and NJ Farm Bureau to implement deer management plans on farmland particularly in areas with high deer densities.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with land stewards, private landowners, and municipal, state and federal staff to establish best management practices in areas where listed or special concern species occur.
- DFW to collaborate with public landholders to manage grassland and early-succession complexes for source populations of grassland birds, invertebrates, yellow-breasted chats, and American kestrels.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with the DEP's Division of Watershed Management to upgrade stream classifications in areas with rare mussels.
- DFW to identify areas where scrub-shrub macro-sites can be created and/or maintained for American woodcocks and northern bobwhite quail without negatively affecting endangered, threatened, or special concern species and their habitats.
- DFW to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, USFWS, and US Department of Agriculture to continue monitoring diseases that can potentially affect wild, native populations of special concern fish species.
- DFW to continue working with fishing clubs and organizations, lake communities, hatcheries nationwide, and individuals permitted to stock fish in NJ's freshwater

- streams and lakes to ensure healthy stock is used to minimize the spread of disease and parasites to native fish species and to prevent the use or release of exotic species.
- DFW will lead the development of educational materials for public and private landowners about wildlife of greatest conservation need and associated habitats.
- State agencies, local municipalities, and townships to work together to discourage managed cat colonies and trap, neuter, and release programs.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, and local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Annually monitor abundance, productivity, distribution, and trends of bald eagle, bog turtle, and wood turtle populations; priority invertebrate species; colonial waterbird, forest passerine, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird communities, particularly in areas beyond the reach of the Breeding Bird Survey.
- Determine distribution and expand efforts to track bobcat in the region.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, the Vernal Pool Project, and the volunteer coverboard surveys.
- Conduct long-term monitoring of vegetative plots (exclosures) within state lands to assess vegetative success/ failure over time as deer densities change.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Develop and implement a simple but effective technique to monitor deer impacts on private land (something that landowners can actually use.).
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.
- Continue monitoring diseases as outlined in the DFW's annual Fish Health Management Plan.

4. Southern Piedmont Plains

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Partnerships to Deliver Conservation*
- g. *Monitoring Success*

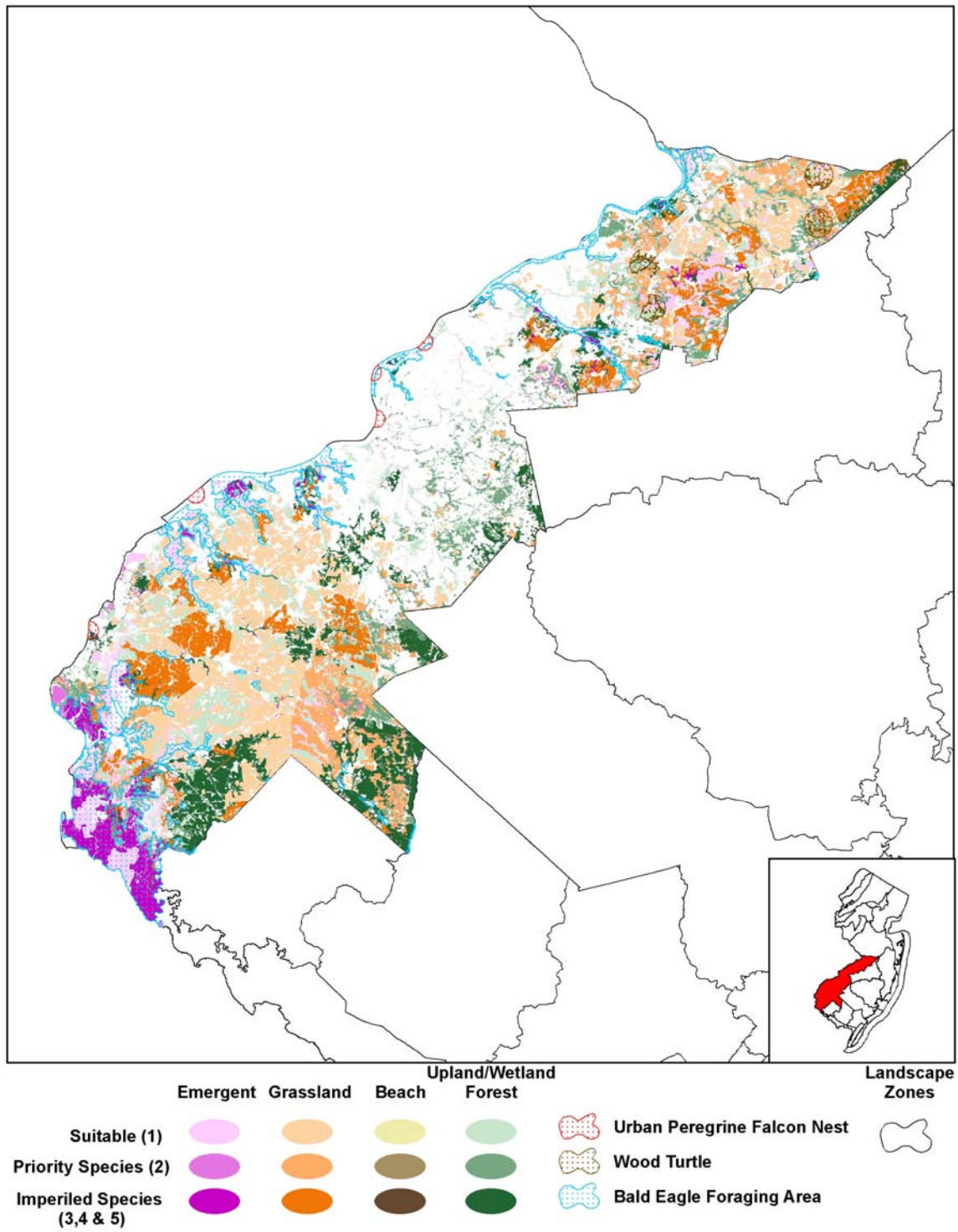
a. Habitats

The Southern Piedmont Plains zone (Figure 21) is the largest zone in the state, with more than 60 percent of the area considered suitable habitat for wildlife of conservation concern. This zone also contains many public natural lands and open space areas including Trenton Marsh, Delaware & Raritan Canal State Park, Rancocas State Park, Parvin State Park, Glassboro WMA, Union Lake WMA, Thundergut Pond WMA, Mannington Meadows WMA, Mad Horse Creek WMA, Abbotts Meadow WMA, Supawna Meadows NWR, Fort Mott, and PSE&G's Alloways Creek.

The Southern Piedmont Plains zone begins just north of Trenton and follows the Delaware River south to the southwest border of Salem County. This zone contains the Delaware River and estuary, which is composed of two important systems – the freshwater tidal river from Trenton to Camden and the brackish upper estuary from Camden to the Cohansey River. The estuary system is composed of brackish and freshwater tidal marshes, tidal flats, and slow moving streams. Tidal freshwater marshes are among New Jersey's rarest yet most valuable habitat types. The Southern Piedmont Plains zone contains the largest concentration of this valuable habitat type. Geologically, this zone is actually within the inner coastal plain physiographic province and includes some of the richest soils in New Jersey. Grasslands are also an important component of the estuary and the region. Grassland habitats in this region include fens, wet meadows, impounded agricultural lands, and upland agricultural lands. Important bald eagle and osprey populations are found here. Bog turtle populations are currently found at the northern end of this zone.

Mad Horse Creek WMA in Salem County is at the southwestern tip of this zone and is characterized by extensive emergent marshland and agricultural lands, much of which is heavily farmed. Salem and Gloucester counties have extensively farmed areas but larger forest and forested wetland complexes are found throughout these counties as well. The domination of row crops provides limited habitat for grassland dependent species. However, area-sensitive, grassland-dependent species such as the upland sandpiper and vesper sparrow are found in large grasslands. Effective management of farmland habitat could help reverse population declines of grassland-dependent wildlife. Maintaining the integrity of existing forests and forested wetlands is also critical in this area since they take many years to mature. These forests should be protected from fragmentation as they provide habitat for wide-ranging species such as forest dwelling bats, bobcats, barred owls, Cooper's hawks, and forest passerines. Wood turtles and other declining reptiles and amphibians also rely on this important habitat.

1 **Figure 21.** Critical landscape habitats within the Southern Piedmont Plains conservation zone,
 2 as identified through the Landscape Map (v2).



b. Wildlife of Greatest Conservation Need

The Southern Piedmont Plains supports one federal endangered species, two federal threatened species, 13 state endangered, 15 state threatened, 76 special concern and regional priority wildlife species, and 13 additional harvested species of regional priority. The bald eagle, bog turtle, and American burying beetle are the federally listed species. The state endangered species include the bobcat, American bittern, northern harrier, peregrine falcon, pied-billed grebe, red-shouldered hawk, sedge wren, upland sandpiper, vesper sparrow, eastern tiger salamander, and timber rattlesnake. State threatened wildlife species include the barred owl, black-crowned night-heron, bobolink, Cooper's hawk, grasshopper sparrow, long-eared owl, osprey, red-headed woodpecker, savannah sparrow, northern pine snake, wood turtle, Pine Barrens treefrog, eastern pondmussel, triangle floater, yellow lampmussel, and frosted elfin. Special concern wildlife species include cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, migratory songbirds, raptors, and scrub-shrub/open field birds, other reptiles, amphibians, and invertebrates. Tidal freshwater emergent marshes in this area are significant spring staging areas for northern pintails that winter in the Atlantic Flyway. In addition, summer populations of forest-dwelling bat species, potentially including the federal endangered Indiana bat, occur here.

The Southern Piedmont Plains is notable for supporting urban nesting peregrine falcons. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats the Southern Piedmont Plains

Table PP31. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle		X	X	X
Reptiles				
Bog turtle		X	X	X
Mussels				
Dwarf wedgemussel	X ***			
Fish				
Shortnose sturgeon	X			

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

***Riverine habitat.

X: Species occurs within the identified habitat.

Table PP32. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat		X		X
Birds				
American bittern		X		X
Henslow's Sparrow		R	R	
Northern harrier		X	X	
Peregrine falcon		X		
Pied-billed grebe		X		
Red-shouldered hawk				X
Sedge wren		X	X	
Short-eared owl			X	
Upland sandpiper			X	

State Endangered Species (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Vesper sparrow			X	
Reptiles				
Timber rattlesnake				X
Queen snake		R		R
Amphibians				
Blue-spotted salamander		R		R
Eastern tiger salamander		X		X
Insects				
Bronze copper			X	X

R: Proposed reintroduction of species.

X: Species occurs within the identified habitat.

Table PP33. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night-heron		X		
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl			X	X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Northern pine snake				X
Wood turtle				X
Amphibians				
Eastern mud salamander		X		
Pine Barrens treefrog		X		
Mussels				
Eastern pondmussel	X*			
Tidewater mucket	X*			
Triangle floater	X*			
Yellow lampmussel	X*			
Insects				
Frosted elfin		X	X	

*Riverine habitat.

X: Species occurs within the identified habitat.

Table PP34. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed myotis				X**
Eastern red bat				X**
Hoary bat				X**
Marsh rice rat			X	
Silver-haired bat				X**
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American golden-plover			X	
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blue-winged warbler		X		X
Broad-winged hawk				X
Brown thrasher				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Cattle egret		X		
Chimney swift				X
Chuck-will's-widow				X
Cliff swallow		X	X	
Common barn owl			X	
Common nighthawk			X	X
Dickcissel			X	
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Forster's tern		X		
Glossy ibis		X		
Gray catbird				X
Great blue heron		X		X
Great crested flycatcher				X
Great egret		X		
Green heron		X		X
Hooded warbler				X
Horned lark			X	
Indigo bunting			X	X
Kentucky warbler				X
King rail		X		
Least bittern		X		
Least flycatcher				X
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern gannet		X		
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Purple finch				X
Red-throated loon		X		
Rose-breasted grosbeak				X
Scarlet tanager				X
Seaside sparrow		X		
Sharp-shinned hawk				X
Snowy egret		X		
Spotted sandpiper		X		
Summer tanager				X
Veery				X
Whip-poor-will				X
Willet		X		
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Coastal plain milk snake		X		X
Eastern box turtle			X	X
Eastern kingsnake				X
Northern diamondback terrapin		X		
Spotted turtle				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Amphibians				
Carpenter frog		X		X
Fowler's toad		X		X
Mussels				
Creeper	X***			
Insects				
A noctuid moth, <i>Chytonix sensilis</i>				X
A noctuid moth, <i>Cucullia alfarata</i>			X	
A noctuid moth, <i>Macrochilo louisiana</i>			X	
A noctuid moth, <i>Macrochila santerivalis</i>			X	
A noctuid moth, <i>Macrochilo sp 1</i>			X	
A slugmoth, <i>Monoleuca semifascia</i>			X	X
A spanworm, <i>Itame sp 1</i>				X
Doll's merolonche, <i>Merolonche dolli</i>				X
Lemmer's pinion moth, <i>Lithophane lemmeri</i>				X
Pink streak, <i>Faronta rubripennis</i>	X			X
Precious underwing, <i>Catocala pretiosa pretiosa</i>				X
Rare skipper, <i>Problema bulenta</i>				X
Scarlet bluet, <i>Enallagma pictum</i>	X	X	X	
<i>Zanclognatha sp 1</i>		X	X	X
Fish				
American brook lamprey*	X			
Atlantic sturgeon	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy - NJ Chapter

**Potential presence.

***Riverine habitat.

X: Species occurs within the identified habitat.

7 Table PP35. Game Species of Regional Priority

8 Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		X
American woodcock				X
Canada goose (Atlantic population)	X	X		
Canvasback	X			
Clapper rail		X		
Greater scaup	X			
Lesser scaup	X			
Northern bobwhite			X	
Northern pintail	X			
Surf scoter	X			
Virginia rail		X		
Wood duck				X
Fish				
Brook trout*	X			

*Species is a New Jersey game species, but is also an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table PP36. Fish Species

Common Name	Water
Fish	
Comely shiner	X
Hickory shad	X
Ironcolor shiner	X
Margined madtom	X
Rainbow smelt	X

X: Species occurs within the identified habitat.

Table PP37. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Although much of this zone retains a rural, farmland character, critical wildlife habitat is threatened in many ways, the greatest of which are fragmentation and disturbance. Roads and development destroy and degrade habitat and are barriers to wildlife movements. Land subject to intensive farming practices decreases habitat value for wildlife. Run-off of pesticides and other contaminants (e.g., PCBs) from residential and agriculture areas into waterways impact breeding success of eagles, ospreys, and amphibians. Ditching, draining, and filling of marshes eliminates habitat and degrades the remaining surrounding areas. This zone is situated entirely within the ports of Wilmington, Delaware and Philadelphia, Pennsylvania, which together support some of the largest petro-chemical facilities in the U.S. As such, this zone faces spill and contaminants related threats that could be potentially catastrophic. Shipping channel expansion or deepening in the Delaware River could have significant implications on salinity levels in tidal freshwater emergent marshes. Disturbance of marsh areas by personal watercraft adversely impacts marsh breeding birds and erodes the water's edge. Invasive species such as common reed or *Phragmites* (*Phragmites australis*), multi-flora rose, bull thistle, and autumn olive eliminate habitat for most grassland and marsh nesting birds. Aquatic nuisance species may render some freshwater systems unsuitable for many fish and aquatic invertebrate species. Breeding populations of non-native trout (brown and rainbow) resulting from stocking for recreational use compete with native populations of brook trout. Furthermore mallards, which thrive in areas with human habitation, compete with and displace American black ducks and have also been known to hybridize with them. In this zone, American black ducks occur along the Delaware River and in western Salem County. In riparian areas, North American beavers can create wetland habitat suitable for many species by damming up streams, but may, in turn, alter riparian habitat downstream from the dam.

White-tailed deer thrive in fragmented non-urban areas and the resulting over-browse of the forest system in this landscape is severe and virtually eliminates forest regeneration. White-tailed deer also selectively browse native vegetation, giving invasive species (barberry species, etc) a stronghold in the forested understory. In addition, fragmented forests face an increased risk of invasion of aggressive weed species such as garlic mustard, Japanese honeysuckle, barberry, oriental bittersweet, and Japanese knotweed. This eliminates habitat for ground-nesting birds and basking and foraging areas for many amphibians and reptiles.

Fragmenting the core integrity of forests and forested wetlands in this zone also threatens critical habitat for forest-interior species such as the bobcat, barred owl, red-shouldered hawk and forest passerines. Clear-cutting of forests renders the habitat unsuitable for many area sensitive forest species. Re-establishing mature forest and forested wetlands takes many years and in particular, Atlantic white cedar swamps are difficult to re-establish once eliminated.

Clearing of vegetation along rivers and streams is a leading cause of habitat loss, fragmentation, and degradation of riparian and aquatic ecosystems. Loss of vegetated buffers along streams and rivers increases runoff of contaminants from roads and developed areas, impacting aquatic communities and the terrestrial wildlife that rely on them. Roads and development that bisect riparian systems are barriers to wildlife movements, isolating less mobile wildlife populations (particularly reptiles, amphibians and fish) and increasing the risk of local extinctions. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect endangered, threatened, and special concern wildlife populations and their habitat through full implementation of Landscape Project, and identify and protect critical aquatic habitat of endangered, threatened, and special concern fish species.
- Identify, protect, enhance, and/or restore important grassland and open-field habitats to maintain viable populations of area-sensitive grassland species.
- Maintain large tracts of forest and forested wetlands to sustain and restore viable populations of area-sensitive forest species (bobcat, woodland raptors, forest-interior birds, wood turtle, timber rattlesnake).
- Identify, protect, maintain, enhance, and restore critical riverine and wetland habitats and water quality to preserve aquatic ecosystems, particularly for marsh nesting birds, freshwater mussels, rare damselflies and dragonflies, nongame fish species and game fish of regional priority that rely on high water quality.
- Maintain and enhance habitat critical for ospreys, bald eagles, peregrine falcons, and bog turtles.
- Prevent, stabilize, and reverse declines of rare freshwater mussels and special concern fish species.
- Assess large-scale habitat change (every five to 10 years).
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Inventory, determine distribution, and monitor wildlife and fish species of greatest conservation need.

- Prevent illegal collection of rare reptiles and amphibians (including bog and wood turtles and timber rattlesnake) and of Asiatic (or Asian) clams, which potentially damage native mussel populations through treading and disturbance of the streambed.
- Protect and enhance important and unique natural communities.
- Identify and protect summer roosting habitat for Indiana bats and other forest-dwelling bat species.
- Protect, enhance, and restore coldwater fish habitat and ecosystems.
- Conserve and enhance wild trout populations at optimal levels.
- Promote public education and awareness and wildlife and fish conservation.
- Develop a fish Index of Biotic Integrity (IBI) to better assess, manage, restore and protect New Jersey's non-trout streams in the Lower Delaware River Drainage

e. Conservation Actions

Priority	Conservation Actions
Protect wildlife populations through Landscape Project critical habitat mapping	
1°	Identify critical core habitats and assess their condition for grassland-dependent species, forest passerines, cavity nesters, bald eagles, coastal marsh birds, bog turtles, mollusks of special concern, reptiles, amphibians, and butterflies and moths of special concern and integrate them into the Landscape Project and the Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Act to protect, maintain, enhance, and/or restore critical habitat for area sensitive species as appropriate. (<i>Protect habitat – Landscape Project</i>)
1°	Identify critical emergent wetlands and estuarine marsh. Develop riparian landscape layer and incorporate into Landscape Project mapping. (<i>Protect habitat – Landscape Project</i>)
1°	Identify critical core forests and assess their condition for forest dwelling bats, forest nesting birds, and bobcat. Identify protection and management strategies to maintain large, core areas in perpetuity. Where appropriate, identify proximate areas that can be managed to enhance forest size. (<i>Protect habitat – Landscape Project</i>)
1°	Provide long-term protection for bald eagle habitats, including land acquisition and protection from human disturbance. (<i>Protect habitat – humans; Conserve wildlife – development, rare wildlife</i>)
1°	Collaborate with other state agencies and non-government organizations to identify all permanently protected and easement-protected land and integrate data into Landscape Project mapping. (<i>Protect habitat – Landscape Project</i>)
1°	Develop baseline data and management strategies for endangered, threatened, and special concern wildlife on permanently protected natural lands. Incorporate all data into Landscape Project and Biotics database. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Incorporate Important Bird Areas into Landscape Project mapping when nominations are finalized. (<i>Protect habitat – Landscape Project, migratory birds</i>)

1

Priority	Conservation Actions (continued)
1°	Incorporate freshwater mussel survey results into Riparian Landscape Project and determine critical areas for listed species. (<i>Protect habitat – mussels, Landscape Project</i>)
1°	Protect rare mussels and fish through Category 1 upgrades in water bodies where listed or special concern species occur. (<i>Protect habitat – mussels</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Monitor wildlife - fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Protect habitat – fish</i>)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Identify and protect important coldwater fish habitat and ecosystems. (<i>Protect habitat – fish</i>)
1°	Develop and implement a habitat improvement and restoration program for coldwater fish. (<i>Protect habitat – fish</i>)
1°	Monitor changes in water quality on specific waterways where summer trout habitat may be in jeopardy due to declining water quality. (<i>Protect habitat – fish</i>)
2°	Review and improve Landscape Project species habitat models and new research and landuse/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect and enhance open-field habitats to maintain area-sensitive grassland species.	
1°	Identify and assess large core grassland habitat and act to protect, enhance, and/or restore habitat through fee purchase, conservation easement, landowner incentives, and/or management plans. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Identify areas where scrub-shrub habitat can be created and/or maintained with little impact to forested, wetland, and grassland habitats to maintain populations of shrub-dependent butterflies and moths, reptiles, amphibians, and scrub-shrub birds such as the yellow-breasted chat, American woodcock and northern bobwhite quail. (<i>Protect habitat – Landscape Project</i>)
1°	Survey suitable habitats annually to determine distribution and trends of grassland and early-successional habitat-dependent species including the bronze copper, frosted elfin, northern harrier and upland sandpiper. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Investigate causes for decline and develop models based on habitat requirements of American kestrel and barn owl; identify most effective methods to restore and enhance habitat and provide nest cavities (standing dead biomass and nest boxes). (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project</i>)

1

Priority	Conservation Actions (continued)
1°	Establish a mosaic of meadow, hay and row crops within open field habitats. Utilize landowner incentive programs for funding. Evaluate/monitor successful nesting rates of grassland birds within these habitats. (<i>Agriculture – land management; Conserve wildlife – rare wildlife</i>)
1°	Conduct demographic studies (productivity, survival, dispersal) of priority species to provide information needed for determining causes of population declines and understanding metapopulation dynamics. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Where appropriate create large grasslands areas by eliminating hedgerows, fences, or tree lines in areas where open land occupies a considerable amount of the surrounding landscape and grassland management is a reasonable management alternative. (<i>Agriculture – land management</i>)
1°	Encourage landowners to delay mowing to allow grassland-dependent species to successfully breed. Convert existing hay and/or row crops to warm season grass fields, where appropriate, using landowner incentive programs. Evaluate effectiveness of delayed mowing between warm season grass fields and cool season hay fields for grassland-dependent species including birds, invertebrates, reptiles, and amphibians. (<i>Protect habitat – humans; Enhance habitat – private lands</i>)
2°	Research different management techniques to understand the appropriateness of prescribed burning, mowing, and other methods for maintaining suitable habitat for northeastern grassland-dependent species including birds, reptiles and amphibians, and invertebrates. (<i>Monitor wildlife – long-term monitoring; Agriculture – land management</i>)
Maintain large tracts of forest and forested wetlands	
1°	Identify suitable habitat and implement best management practices for forest-interior passerines, woodland raptors, bobcats, wood turtles, forest-dwelling bats, and waterfowl. Decrease fragmentation of large forest patches due to unsustainable forestry practices. (<i>Enhance habitat – private lands; Protect habitat – Landscape Project</i>)
1°	Identify and assess large core forest and forested wetland habitat and act to protect, enhance, and/or restore habitat through fee purchase, conservation easement, landowner incentives, and/or management plans. Protect and enhance forests and forested wetlands greater than 10 hectares (24.7 acres) of forest core area and a canopy closure of greater than 80%. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Identify, protect, and maintain coniferous forests with >70% forest cover for priority bird species (black-throated green warbler, blue-headed vireo, northern parula), reptiles and amphibians. (<i>Protect habitat – Landscape Project</i>)

2

1

Priority	Conservation Actions (continued)
1°	Act to protect, maintain, enhance, restore, and/or create habitat, as appropriate. Manage forests for larger, more mature woodlands with large trees for cavity-nesters and with a canopy closure of > 80%. Maintain and enhance floodplain forests for forest passerines. Manage forest habitats for woodland raptor suitability. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl, red-shouldered hawk, wood turtle and northern pine snake habitat. (<i>Protect habitat – Landscape Project; Silviculture – land management</i>)
1°	Discourage forestry practices that cut small habitat patches in forest patches that provide forest core areas of at least 25 acres. (<i>Silviculture – land management</i>)
1°	Establish or restore forested corridors between core forest patches and allow riparian areas to become reforested. Encourage stream bank stabilization using native plants. (<i>Enhance habitat – private lands; Corridors – sprawl</i>)
1°	Select and manage woodlots to maintain dead trees, reduce understory, and thin tree stands for open-woodland species and cavity-nesters such as red-headed woodpeckers. (<i>Silviculture – land management</i>)
1°	Select and manage woodlots to maintain structural forest diversity, esp. shrub understory for forest passerines (Kentucky warblers, Louisiana waterthrushes, wood thrushes) and priority reptiles, amphibians, and invertebrate species. (<i>Silviculture – land management</i>)
1°	Continue to monitor barred owl distribution. Manage forests for larger trees with a canopy closure of > 80%. Preserve old growth Atlantic white cedar swamps and mixed forested wetlands. (<i>Monitor wildlife – long-term monitoring; Silviculture – land management</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species in this zone. Implement innovative and proactive habitat conservation plans to meet and maintain recovery goals. (<i>Conserve wildlife – rare wildlife</i>)
Maintain and restore critical habitat for wetland/riparian species.	
1°	Maintain larger buffers around wetlands, riparian and floodplain areas and minimize destruction. Encourage native plantings to stabilize stream banks and prevent erosion. (<i>Protect habitat – Landscape Project</i>)
1°	Protect all freshwater wetlands larger than 4.8 hectares (11.8 acres) from development, draining, and other forms of habitat loss through regulatory process, fee purchase, conservation easement or landowner incentive programs. (<i>Protect habitat – development, humans</i>)
1°	Wetlands used as breeding sites should be protected from chemical contamination, siltation, eutrophication, and other forms of pollution/contamination that could directly harm wetland-dependent species (birds, invertebrates, reptiles, amphibians) or their food supply. (<i>Conserve wildlife – contaminants</i>)

1

Priority	Conservation Actions (continued)
1°	Preserve and protect occupied and potential habitat for black rails and sedge wren; restrict human activity from nesting sites; preserve surrounding wetlands. (<i>Protect habitat – development, humans</i>)
1°	Maintain and enhance critical wetland habitat for sedge wrens, American bitterns, rails, night-herons, Pine Barrens treefrogs, and eastern tiger salamanders. (<i>Conserve wildlife – rare wildlife</i>)
1°	Manage freshwater wetlands for pied-billed grebes and other wetland dependent species including rails, waterfowl, and invertebrates: create impoundments, maintain stable water levels during nesting season, restrict recreational activity, monitor contaminant levels; hemi-marsh conditions (area with approximately 50% water and 50% emergent vegetation cover) favored by grebes need to be maintained by periodic reversal of vegetation succession to open up some of the extensive stands of emergent vegetation. Suitable habitat for nesting needs to be maintained in nearby areas during wetland management. (<i>Protect habitat – humans; Conserve wildlife – rare wildlife</i>)
1°	Identify and maintain wetlands with snags of dead trees for red-headed woodpeckers and other cavity-nesters. (<i>Protect habitat – development; Silviculture – land management</i>)
1°	Identify and assess large core wetland and riparian habitat and act to protect, enhance, and/or restore habitat through fee purchase, conservation easement, landowner incentives, and/or management plans. (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Identify threats to vernal pools and devise strategies to protect species dependent upon vernal pool habitat. (<i>conserve wildlife – rare wildlife</i>)
1°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulations database and Landscape Project (<i>Protect habitat – Landscape Project</i>)
1°	Research and evaluate effectiveness of water quality management practices on marsh nesting birds, eastern tiger salamanders, bog turtles, and aquatic invertebrates. (<i>Conserve wildlife – rare wildlife</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Enhance habitat – private lands</i>)
2°	Study how land use practices such as ditching, impounding, dredging, open marsh water management, burning, and marsh restoration impact species in this suite. (<i>Conserve wildlife – rare wildlife</i>)
Maintain and enhance habitat critical for bog turtles, ospreys, bald eagles, and peregrine falcons	
1°	Restore and maintain bog turtle habitat; provide incentives to landowners for long-term management of wet meadows by implementing prescribed grazing. (<i>Conserve wildlife – rare wildlife</i>)
1°	Act to protect, maintain, and/or restore habitat as appropriate for bald eagles, ospreys, and peregrine falcons. Enlist citizen scientists to monitor and protect nests from human disturbance. (<i>Conserve wildlife – rare wildlife; Protect habitat – humans</i>)

1

Priority	Conservation Actions (continued)
Prevent, stabilize, and reverse declines of rare freshwater mussels and rare fish populations	
1°	Protect water quality by maintaining larger buffers around wetlands, riparian and floodplain areas and minimizing destruction. (<i>Protect habitat – Landscape Project</i>)
1°	Seek Category 1 upgrades for Pompeston Creek and other tributaries with listed aquatic species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Protect water quality in occupied waterways to preserve populations of nongame fish species. (<i>Protect habitat – fish</i>)
1°	Assess impact of aquatic invasive species on freshwater mussels. Implement management strategy to eliminate aquatic invasive species in sensitive or important habitats containing listed freshwater mussels. (<i>Conserve wildlife – invasives</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Conserve wildlife – rare wildlife</i>)
1°	Monitor and develop management strategies for coldwater fisheries in large reservoirs. (<i>Protect habitat – humans</i>)
1°	Routinely monitor fish populations, including wild trout, in order to keep management strategies current, aid in the identification of resource problems and issues, and demonstrate agency commitment to the management of aquatic resources. (<i>Monitor wildlife – fish</i>)
1°	Protect endangered and threatened fish by using concentrated field sampling for listed or special concern species at areas indicated by FishTrack Database queries. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop management strategies to assure the protection of the state's valuable wild coldwater fisheries. (<i>Protect habitat – humans</i>)
1°	Evaluate current management practices that may negatively impact wild trout populations. (<i>Protect habitat – humans</i>)
1°	Protect wild trout populations through the use of established fishing regulations. (<i>Protect habitat – humans</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – development</i>)
2°	Research effects of parasites and diseases on populations of special concern fish species. (<i>Conserve wildlife – rare wildlife</i>)
2°	DFW to give priority attention to species of greatest conservation need in planning or implementing any response to any exotic pathogen introduction or incident. (<i>Conserve wildlife – invasives</i>)

1

Priority	Conservation Actions (continued)
Assess large-scale habitat change every five years	
1°	Collaborate with NJ DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years.
1°	Perform critical habitat change analysis to assess trend in habitat loss and conversion. (<i>Protect habitat – Landscape Project</i>)
Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and overabundant species	
1°	Identify areas where invasive, non-indigenous plants and animals are either already established or are becoming established through surveys and public participation. Prioritize areas for control measures. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the Asian longhorned beetle and gypsy moth. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
1°	Eliminate aggressive invasive terrestrial species in large grassland tracts; assess effectiveness of management techniques of invasive species removal on private and public lands. (<i>Conserve wildlife – invasives; Evaluate restoration – invasives</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. (<i>Evaluate restoration – deer; Conserve wildlife – deer</i>)
1°	Continue to develop and expand incentives for harvesting antlerless deer such as “earn-a-buck.” (<i>Conserve wildlife – deer</i>)
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Evaluate restoration – deer; Conserve wildlife – deer</i>)
1°	Develop and implement, through regulations or legislation, programs that require farmers to achieve deer management goals, including harvest quotas, to obtain farm tax assessment or to qualify for farmland preservation programs. (<i>Conserve wildlife – deer</i>)

1

Priority	Conservation Actions (continued)
1°	Support projects to eliminate aggressive invasive species found on private and public natural lands especially in wet meadow, marsh, and emergent wetland habitats. (<i>Conserve wildlife – invasives</i>)
2°	Request permission from private landowners (both those who allow hunting and do not allow hunting) to establish vegetation monitoring plots. This will allow greater surveillance of deer impacts on private lands, provide landowners direct information about the health of their land, and provide greater data input into the deer harvest formula. (<i>Evaluate restoration – deer</i>)
2°	Develop programs with partner organizations to effectively and efficiently remove invasive weed species from key areas. (<i>Conserve wildlife – invasives</i>)
2°	Develop and implement invasive species management strategies in critical wildlife habitats. (<i>Conserve wildlife – invasives</i>)
Inventory, determine distribution, and monitor wildlife	
1°	Develop and implement proactive species recovery plans for all endangered and threatened species in this zone. Implement innovative and proactive habitat conservation plans to meet and maintain recovery goals. (<i>Conserve wildlife – rare wildlife</i>)
1°	Survey suitable habitats to determine distribution and trends of the shortnose sturgeon, dwarf wedgemussel, blue-spotted salamander, queen snake, bronze copper, frosted elfin and other species with little known distribution patterns in this zone. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Establish standardized long-term monitoring protocol utilizing citizen scientists for wildlife of greatest conservation need and determine baseline abundance for these groups. Incorporate new data into Landscape Project and the Biotics database. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Determine carrying capacity of freshwater tidal marshes for spring staging waterfowl of conservation concern. (<i>Conserve wildlife – game species</i>)
1°	Conduct surveys to find more information about the species and management requirements of rails and sedge wrens. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct surveys in Delaware River tributaries to determine distribution of eastern pondmussels, tidewater mucklets and yellow lampmussels. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)
1°	Conduct surveys in suitable, previously unsurveyed areas to determine if listed or special concern freshwater mussel species are present. Repeat surveys every four years to monitor populations. (<i>Monitor wildlife – fish</i>)
2°	Determine distribution and expand efforts to track bobcats in the region. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
Prevent illegal collection of rare reptiles, amphibians, and Asiatic (or Asian) clams	
1°	Notify the NJ Division of Fish and Wildlife's Bureau of Law Enforcement of critical sites (nesting, basking, gestation, dens) to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (including bog and wood turtles), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles, clam harvesting). (<i>Protect wildlife – humans</i>)
2°	Recruit and educate local law enforcement of endangered species laws. Develop a partnership between them and the NJ Division of Fish and Wildlife's Bureau of Law Enforcement to enforce protection of native wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
Protect and enhance important and unique habitats	
1°	Work with state agencies and local governments to map significant natural communities in the Southern Piedmont Plains. (<i>Protect habitat – Landscape Project</i>)
1°	Identify, protect, and enhance critical migratory stopover habitats such as Glassboro WMA. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Work with local governments and NJ DEP's Natural Heritage Program (NHP) to protect and enhance the high quality floodplain forest natural community at Walnford Floodplain. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Continue to support the protection of tidal freshwater marshes along the Delaware River. (<i>Protect habitat – development</i>)
1°	Work with local governments and NHP to protect and enhance the hardwood swamp natural community and federal threatened plant species at United States Ave, Hidden Lake, Toms Branch, and Campus Swamp sites. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Continue to support the protection of the tidal brackish marsh and river drainages of Mannington Meadows Macrosite. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
1°	Continue to support the protection of the hardwood swamp natural community and federal threatened plant species at Glassboro Woods in Glassboro WMA. (<i>Protect habitat – development; Conserve wildlife – rare wildlife</i>)
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Protect, enhance, and restore coldwater fish habitat and ecosystems	
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Develop and implement a habitat improvement and restoration program. (<i>Restore aquatic habitat - development</i>)
1°	Monitor changes in water quality on specific waterways where summer trout habitat may be in jeopardy due to declining water quality. (<i>Monitor wildlife – fish</i>)
Conserve and enhance wild trout populations at optimal levels	
1°	Routinely monitor wild trout populations to revise management strategies when appropriate, aid in the identification of resource problems and issues, and demonstrate agency commitment to the management of aquatic resources. (<i>Monitor wildlife – fish</i>)
1°	Develop management strategies to assure the protection of NJ's valuable wild coldwater fisheries. (<i>Protect habitat – humans</i>)
1°	Evaluate current management practices that may negatively impact wild trout populations. (<i>Protect habitat – humans</i>)
1°	Protect wild trout populations through the use of established fishing regulations. (<i>Protect habitat – humans</i>)
Promote public education and awareness and wildlife and fish conservation	
1°	Restore and enhance habitat on private lands through active partnerships with non-governmental organizations and state and federal partners. Promote existing landowner incentive programs to protect important habitat for rare species management. (<i>Conserve wildlife – development; Enhance habitat – private lands</i>)

1

Priority	Conservation Actions (continued)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve them in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is the key to successful control. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Collaborate with partners to develop innovative outreach educational programs to protect important habitats. Promote incentive programs to encourage agricultural landowners to actively manage for grassland dependent species. (<i>Education – humans; Agriculture – land management</i>)
1°	Develop and maintain educational materials, and viewing and recreational opportunities for the public consistent with species recovery goals to enhance public awareness of wildlife conservation and environmental issues by cooperating with federal, state and non-governmental organization partners. (<i>Education – humans</i>)
1°	Develop a field guide to NJ's freshwater mussel species to assist in promoting public education and increase awareness of New Jersey's native freshwater mussel fauna. (<i>Education – humans</i>)
1°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
1°	Work to develop a statewide policy for local communities to discourage managed cat colonies and trap, neuter and release programs. Educate public about keeping cats indoors; (<i>Education – humans; Conserve wildlife – cats, subsidized predators</i>)
2°	Develop and maintain educational materials about nongame and coldwater fish for dissemination to the public. (<i>Education – humans</i>)
Develop a fish IBI for non-trout streams	
1°	Seek Category 1 classifications in stream segments with high levels of biological integrity based on fish assemblages. (<i>Protect habitat – fish</i>)
1°	Seek other appropriate classifications for stream segments based on IBI results. (<i>Protect habitat – fish</i>)

2

3 **f. Potential Partnerships to Deliver Conservation**

4 Private Landowners

- 5 • Protect and enhance habitat through innovative partnerships with private landowners.
 - 6 ○ Implement best management practices that protect nesting and foraging sites of bald
 - 7 eagle, forest passerine, freshwater wetland bird, raptor, and scrub-shrub/open field
 - 8 bird populations.
 - 9 ○ Utilize incentive programs that encourage the management of bog turtle, forest and
 - 10 grassland bird populations.

- Utilize landowner incentive programs to protect water quality and riparian habitat in areas where rare mussels occur.
- Through incentive programs, target private landowners surrounding public natural lands to manage land for mature forest in order to increase effective size and connectivity of forest patches.
- Encourage farmers to preserve farmland through conservation easements and Transfer of Development Rights (TDRs) through partnerships with NJ DEP's Green Acres, the Nature Conservancy – NJ Chapter, SADC, NJ Farm Bureau, local land trusts, and local municipalities for the conservation of bog turtle, forest and grassland bird populations.
- Develop/maintain cooperative relationships with private landowners with bog turtles, bald eagles, and breeding freshwater wetland birds on their land.
- Work with landowners to maintain/enhance riparian areas through stream bank restoration and planting native vegetation.
- Work with landowners to protect water quality by minimizing use of fertilizers and pesticides.
- Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
- Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
- Work with landowners to maintain/enhance existing habitats where listed and special concern fish species and native trout populations occur.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration, and searching for undocumented freshwater mussels and wetland bird populations.
 - Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas.
 - Continue volunteer-based summer bat concentration surveys.
- Distribute habitat management booklets (grassland, vernal pool, backyard habitat) to landowners with appropriate habitat to encourage good stewardship of their properties.

- Collaborate/partner with local conservation groups (D&R Greenways) in their on-the-ground outreach efforts (clean-ups, restoration plantings, festivals, etc.).
- Promote backyard habitat management for reptiles and amphibians, invertebrates, migratory raptors, and passerines.
- Work with landowners to maintain/enhance existing habitats where special concern species occur.
- Work with landowners to maintain/enhance existing trout populations.
- Educate public about keeping cats indoors; discourage managed cat colonies and trap, neuter and release programs.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field and grassland birds.
- Collaborate with the National Native Mussel Conservation Committee and other experts to develop best management practices for areas with listed and special concern species.
- Work with the American Museum of Natural History to maintain existing NY/NJ freshwater mussel web site.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with conservation organizations to protect and enhance habitats.
 - Protect bald eagle, peregrine falcon, osprey and woodland raptor nesting and foraging sites.
 - Protect important foraging, basking, and den sites for timber rattlesnakes and northern pine snakes.
 - Protect important vernal pond sites and the surrounding upland habitat.
 - Protect nesting and foraging sites for scrub-shrub/ open field and grassland birds.
 - Develop best management practices and conservation plans for utility rights-of-way.
 - Protect and enhance riparian habitats for aquatic and semi-aquatic species, as well as riparian users.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
 - Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.
- Consult with conservation organizations to develop educational programs.
- Support and collaborate with D&R Greenway's efforts to preserve and enhance Trenton Marsh.
- Develop management guidelines and implementation strategies for species/habitats under conservation easements in cooperation with the easement holder (land trusts, conservation organizations, state and federal agencies) and landowner.
- Establish data-sharing partnerships to ensure species data from other organizations' surveys are incorporated into the Landscape Project and the Biotics database.

- Encourage the use of priority habitat maps to guide land acquisition by conservation organizations through programs such as Green Acres Program, State Agricultural Development Committee (SADC), NJ Farm Bureau, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Continue to develop partnerships with fishing- and conservation-oriented organizations to increase conservation and restoration efforts on streams and lakes that provide trout fishing opportunities.
- Conservation organizations should act as advocates for legislation and regulatory reform that address integrating deer management goals into farmland tax assessment laws, farmland preservation programs, and other farm conservation programs.
- Work with land trusts to develop and implement deer management plans that achieve desired deer densities on preserved lands
- Continue to develop partnerships with fishing and conservation oriented organizations to increase conservation and restoration efforts on streams and lakes that provide trout fishing opportunities.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies, including municipal and county planning boards, USFWS - NJ Field Office, SADC, NJ Farm Bureau, and USDA's NRCS, and the DCA, Office of Smart Growth to protect, enhance, and create habitats, and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) to protect bald eagle and woodland raptor nesting and foraging sites.
 - DFW and the DEP's Division of Parks and Forestry (DPF) to protect nesting and foraging sites for scrub-shrub/ open field and grassland birds.
 - DFW and the USFWS to develop a plan to protect sensitive bald eagle, bog turtle, and wood turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.
 - DFW will lead in the prevention of the illegal harvesting of Asian (or Asian) clams, which potentially damages native mussel populations through treading and disruption of habitat.
 - DFW to work with the DEP's Land Use Regulation Program (LURP) to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
 - DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
 - DFW to lead in the development of specific conservation plans for special concern birds, reptiles, amphibians, and invertebrates on state lands.
 - DFW and DPF to work with the USFWS and National Park Service to develop effective plans to eradicate invasive, non-indigenous plants on federal and state lands and aquatic systems that are threatening critical wildlife habitats.
 - DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.

- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- Continue to interact with other state agencies on operational, regulatory, and land-use issues to ensure adequate consideration is given to coldwater fish resources.
- Continue to participate in the review of Land Use Applications that have the potential to impact wild trout populations.
- DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW and USDA-NRCS to collaborate with SADC and NJ Farm Bureau to implement deer management plans on farmland particularly in areas with high deer densities.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and other forest dwelling species on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
- DFW, conservation organizations, and land stewards to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels.
- DFW to work with state and county mosquito commissions to reduce the use of deleterious insecticides and biological controls at known amphibian breeding sites.
- DFW to determine groundwater recharge areas for bog turtle habitats with the DEP's Division of Water Quality and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality in these areas.
- DFW to work with the Division of Watershed Management and the DEP's Bureau of Water Monitoring and Standards to recommend stream classification upgrades in stream segments where listed mussel species and other special concern species occur.

- Collaborate with DEP's Bureau of Geographic Information and Analysis and Rutgers Center for Remote Sensing and Spatial Analysis to develop methods to update DEP's land use/land cover data every five years
- DFW to identify areas where scrub-shrub macro-sites can be created and/or maintained for American woodcocks and northern bobwhite quail without negatively affecting endangered, threatened, or special concern species and their habitats.
- DFW to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW, USFWS, and US Department of Agriculture to continue monitoring diseases that can potentially affect wild, native populations of special concern fish species.
- DFW to continue working with fishing clubs and organizations, lake communities, hatcheries nationwide, and individuals permitted to stock fish in NJ's freshwater streams and lakes to ensure healthy stock is used to minimize the spread of disease and parasites to native fish species and to prevent the use or release of exotic species.
- DFW to continue to interact with other state agencies on operational, regulatory, and land-use issues to ensure adequate consideration is given to coldwater fish resources.
- DFW to continue to participate in the review of Land Use Applications that have the potential to impact wild trout populations.
- DFW will work with DEP's Bureau of Water Monitoring and Standards to recommend appropriate stream classifications
- DFW will lead the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through colonial waterbird viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Annually monitor abundance, productivity, distribution, and trends of bald eagle, bog turtle, and wood turtle populations; and of colonial waterbird, forest passerine, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird communities, particularly in areas beyond the reach of the Breeding Bird Survey.
- Monitor contaminant levels that may impact bald eagle populations.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, the Vernal Pool Project, and the volunteer coverboard surveys.
- Conduct surveys for listed and special concern freshwater mussel species every four years to monitor populations.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants and fish.

- 1 • Conduct long-term monitoring of vegetative plots (exclosures) within state lands to assess
- 2 vegetative success/ failure over time as deer densities change.
- 3 • Continue to monitor deer densities and deer harvest data.
- 4 • Develop and implement a simple but effective technique to monitor deer impacts on private
- 5 land.
- 6 • Develop indicator metrics for monitoring forest health and implement at the scale necessary
- 7 to monitor effectiveness of deer management strategies.
- 8 • Continue monitoring diseases as outlined in the DFW's annual Fish Health Management
- 9 Plan.
- 10

Pinelands Landscape

Contents of the Chapter on the Pinelands Landscape

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- D. *Wildlife of Greatest Conservation Need*
- E. *Threats to Wildlife and Habitats of the Pinelands Landscape Region*
- F. *Conservation Zones, Assessments, and Strategies*
 - 1. *Southern Pinelands*
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 - 2. *Western Pinelands*
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The Pinelands Landscape, or the “Pine Barrens,” is the vast tract of pitch-pine forest that extends from the Atlantic coast into south-central New Jersey. The Pinelands extend through Ocean, Burlington, Camden, Gloucester, and Atlantic counties, with a total area equaling 474,331 hectares (1,831 sq. mi.). The Great Egg Harbor and Mullica Rivers and the Barnegat Bay watershed are the largest aquatic features of the Pinelands.

A. Ecological Units in the Pinelands Landscape

The Pinelands are within the New Jersey Outer Coastal Plain (232Ab) in the Middle Atlantic Coastal Plain Section.

B. Geology and Climate

The Pinelands are within the Coastal Plain physiographic province. The Pinelands have broad valleys that gently rise from the Atlantic coast to hills no higher than 60 meters (196 feet). The average temperature across the Pinelands is between 10 to 12° C (50 to 53.6° F) and the growing season varies from 180 to 225 days. The annual precipitation averages between 101 and 116 cm (39 and 45 inches).

C. Habitats and Conservation Priority Areas of the Pinelands Landscape

The Pinelands (Figure 22) stretch to the vast tidal salt marshes before the barrier islands and to the inter coastal plain along the west, with the Delaware Bay landscape to the south and the Piedmont Plains to the north. Pitch pine-oak forests dominate the Pinelands (318,542 hectares, 1,229 sq. mi.) and these forests are plentiful with wetlands – sluggish streams, white cedar swamps, hardwood swamps, cranberry bogs – and open to broad tidal estuaries before the Atlantic coast (18,269 hectares or 70 sq. mi. of wetlands). Upland agriculture and grasslands make up 35,782 hectares (138 sq. mi.) of the Pinelands. It is important to note that habitats identified as “grassland” within the Landscape Map and throughout this document include agricultural lands and therefore, are not necessarily suitable habitats for grassland species.

1 Similarly, scrub/shrub habitat is included in the “forest” and “forested wetlands” habitats on the
2 Landscape Maps.

3
4 State law has protected the Pinelands ecosystem and its unique wildlife and habitats since 1979,
5 when the New Jersey Legislature passed the Pinelands Protection Act. This action followed the
6 passing of federal legislation in 1978, which directed New Jersey to establish a Commission for
7 the Pinelands and to allocate funds for land acquisition and planning in this region.

8 Development within most of the Pinelands National Reserves is now overseen by the Pinelands
9 Commission, which controls growth pursuant to its Comprehensive Management Plan (CMP).

10
11 Conservation Zones in the Pinelands Landscape are:

- 12
- 13 (1) Southern Pinelands
- 14 (2) Western Pinelands
- 15 (3) Mullica River Watershed
- 16 (4) Northern Pinelands

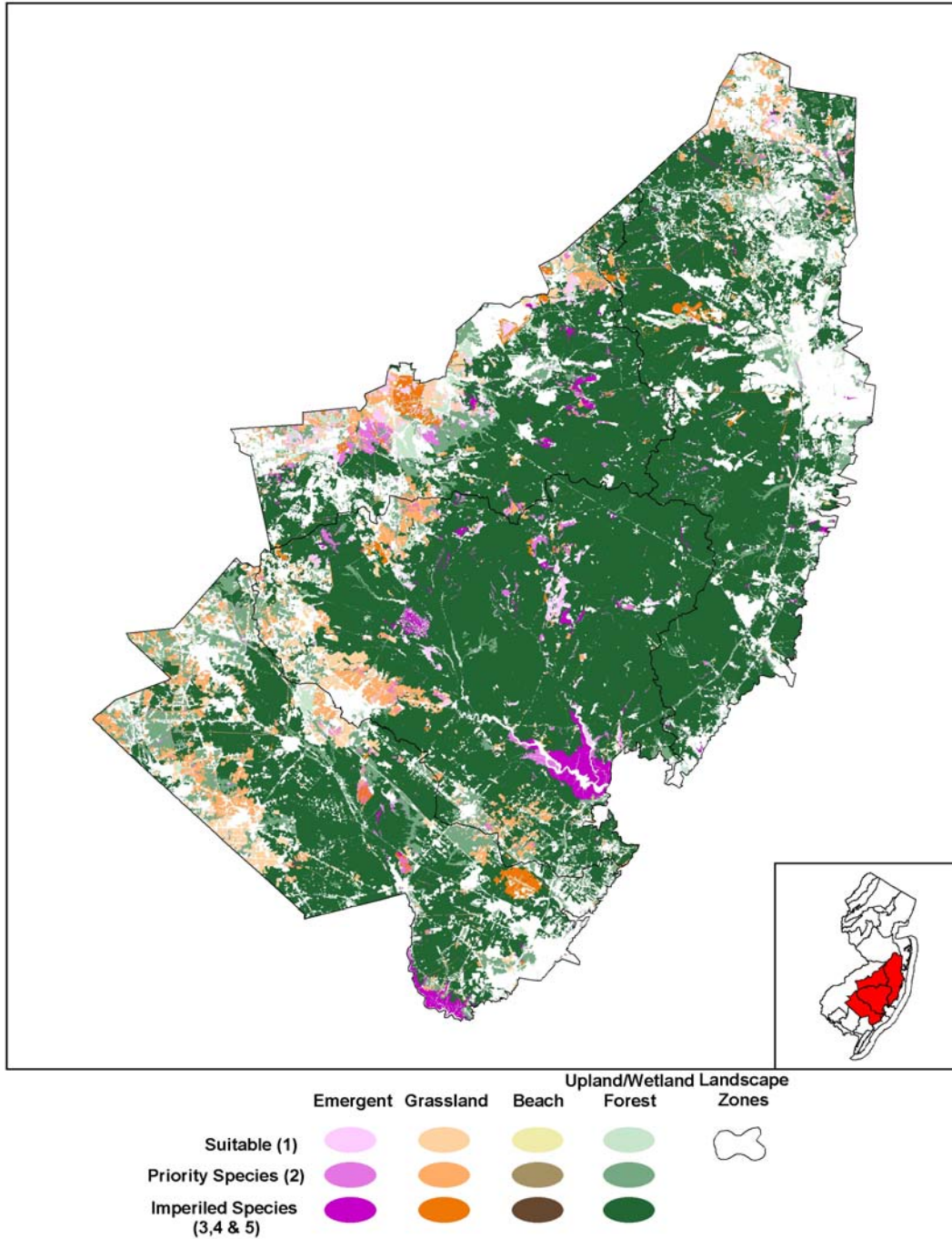
17
18 Within the Pinelands Landscape Region, conservation zones are delineated by watershed
19 boundaries (Watershed Management Areas or WMAs), which the New Jersey Department of
20 Environmental Protection’s Division of Watershed Management has established. The Southern
21 Pinelands Zone is comprised mainly of the Great Egg Harbor Watershed (WMA 15), but also
22 contains a small portion of the northern edge of the Maurice, Salem, Cohansey Watershed
23 (WMA 17). The Western Pinelands Zone contains a very small portion of the Lower Delaware
24 Watershed (WMA 18), with the remainder of the zone made up of the Rancocas Watershed
25 (WMA 19) and the Assiscunk, Crosswicks, Doctors Watershed (WMA 20). The largest of the
26 four zones in this region is the Mullica River Watershed Zone, which is comprised entirely of the
27 Mullica Watershed (WMA 14). The Northern Pinelands Zone is primarily contained within the
28 Barnegat Bay Watershed (WMA 13), but also includes a small portion of the Monmouth
29 Watershed (WMA12) and Lower Raritan, South River, Lawrence Watershed (WMA 9).

30 31 **D. Wildlife of Greatest Conservation Need of the Pinelands Landscape**

32 With its unique habitats, the Pinelands Landscape is host to several threatened and endangered
33 species that are found in few other areas of New Jersey. Species such as Pine Barrens treefrog,
34 corn snake, timber rattlesnake, arogos skipper, and pine snake occur as disjunct populations in
35 the Pinelands, with no natural connections to other populations of these species. This high
36 degree of isolation makes proper habitat management of the Pinelands Landscape essential for
37 the long-term viability of these species in New Jersey. The large contiguous forest patches of the
38 Pinelands are also important for nesting forest passerines and as migratory bird stopovers. This
39 landscape region is therefore crucial for the viability of these species as well. The habitats in the
40 Pinelands play an accessory role for species and species groups such as eastern box turtles,
41 northern diamondback terrapins, grassland birds, and osprey.

42
43 The Pinelands support two federal threatened species, 11 state endangered species, 15 state
44 threatened species, and more than 60 special concern/regional priority wildlife species. The

1 **Figure 22.** Critical landscape habitats within the Pinelands Landscape and associated
 2 conservation zones as identified through the Landscape Map (v2).



Pinelands host a number of imperiled habitat-specialists, including corn snake, northern pine snake, and Pine Barrens treefrog. Bald eagles, cavity-nesters, forest passerines, raptors and scrub-shrub/open field birds inhabit the forests and fields of this region. Coastal plain milk snakes, eastern box turtles, eastern kingsnakes, spotted turtles, timber rattlesnakes, wood turtles, Cope's gray treefrogs, carpenter frogs, Fowler's toads, and marbled salamanders populate the pine forests, forested wetlands, meandering streams, swamps, and bogs. The region's forests and riparian areas are also known to host populations of forest-dwelling bats and may contain habitat suitable for summer colonies of Indiana bats. Finally, the Pinelands have large tracts of suitable habitat capable of supporting remnant bobcat populations.

The following tables list the wildlife of greatest conservation need, the suites of wildlife, and the conservation opportunity areas to conserve them in the Pinelands Landscape. The wildlife are prioritized by federal endangered and threatened, state endangered, state threatened, and special concern and regional priority status.

Prioritized List of the Wildlife of Greatest Conservation Need and their Location in the Pinelands Landscape

Table P1. Federal Endangered and Threatened Species*

Common Name	Fed Status & Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Mammals					
Indiana bat	E	R**	R**	R**	R**
Birds					
Bald eagle	T	I	I	I	I
Reptiles					
Bog turtle	T		I		I

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

T: Federally threatened species.

E: Federally endangered species.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table P2. State Endangered Species

Common Name	Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Mammals					
Bobcat					R
Birds					
American bittern	RP		I		
Black skimmer	RP	M		M	M
Least Tern	RP				M
Red-shouldered hawk		I	I	I	I
Upland sandpiper	RP	I			I
Vesper sparrow			I		I
Reptiles					
Corn snake				I	I
Timber rattlesnake			I	I	I
Amphibians					
Cope's gray treefrog					I

State Endangered Species (continued)

Common Name	Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Insects					
Arogos skipper			I	I	

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table P3. State Threatened Species

Common Name	Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Birds					
Barred owl		I	I	I	I
Black-crowned night heron	RP	I		I	I
Bobolink		I	I		
Cooper's hawk	RP	I	I	I	I
Grasshopper sparrow	RP	M	M		X
Osprey		M		M	M
Red-headed woodpecker	RP	I	I	I	I
Savannah sparrow			M		X
Yellow-crowned night heron	RP	M			
Reptiles					
Northern pine snake		I	I	I	I
Wood turtle					I
Amphibians					
Eastern mud salamander			R	R	
Pine Barrens Treefrog		I	I	I	I
Invertebrates					
Frosted Elfin		I			
Silver-bordered fritillary			I		

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table P4. Nongame Species of Conservation Concern

Common Name	Conservation Status	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Mammals					
Eastern red bat	RP	R*	R*	R*	R*
Eastern small-footed myotis	S1, G3	R*	R*	R*	R*
Hoary bat	RP	R*	R*	R*	R*
Marsh rice rat	S3, G5	X	X	X	X
Silver-haired bat	RP	R*	R*	R*	R*
Southern bog lemming	S2, G5	X	X	X	X
Birds					
Acadian flycatcher	RP	M	M	M	M
American kestrel	SC	I	I	I	I
Baltimore oriole	RP	I	I	I	I
Black-and-white warbler	RP	I	I	I	I
Black-billed cuckoo	RP	I	I	I	I
Black-throated green warbler	SC	I	I		I
Blue-winged warbler	RP	I	I	I	I
Broad-winged hawk	SC/ RP	M	M	M	M
Brown thrasher	RP	M	M	M	M
Cattle Egret	RP	M			
Cerulean warbler	SC/ RP	M			M
Common Barn owl	SC	I	I	I	I
Common nighthawk	SC	M	M	M	M
Dickcissel	RP		M	M	
Eastern kingbird	RP	M	M	M	M
Eastern meadowlark	SC/ RP	M	M	M	M
Eastern screech-owl	RP	M	M	M	M

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Birds (continued)					
Eastern towhee	RP	I	I	I	I
Eastern wood-pewee	RP	I	I	I	I
Field sparrow	RP	I	I	I	I
Gray catbird	RP	M	M	M	M
Great blue heron	SC/ RP	M	M	M	M
Great crested flycatcher	RP	I	I	I	I
Great egret	RP	M	M	M	M
Green heron	RP	M	M	M	M
Hooded warbler	RP	M	M	M	
Horned lark	SC	M	M		M
Indigo bunting	RP	M	M	M	M
Kentucky warbler	SC/ RP	I	I	I	
King rail	SC/ RP	M	M	M	
Least flycatcher	SC/ RP	I		I	I
Little blue heron	SC/ RP	M		M	M
Louisiana waterthrush	RP	M	M	M	M
Marsh wren	RP	M		M	M
Northern flicker	RP	I	I	I	I
Northern parula	SC	M	M	M	M
Pine warbler	RP	M	M	M	M
Prairie warbler	RP	I	I	I	I
Prothonotary warbler	RP	I	I	I	
Rose-breasted grosbeak	RP	I	I	I	I
Saltmarsh sharp-tailed sparrow	RP	M		M	M
Scarlet tanager	RP	I	I	I	I
Seaside sparrow	RP	M		M	M
Snowy egret	SC/ RP	M		M	M
Spotted sandpiper	SC	M	M	M	M
Tricolored heron	SC/ RP	M		M	M
Veery	SC	I	I	I	
Whip-poor-will	RP	I	I		I
Wood thrush	RP	I	I	I	I
Worm-eating warbler	RP	M	M	M	M
Yellow-billed cuckoo	RP	I	I	I	I
Yellow-breasted chat	SC/ RP	M	M	M	M
Yellow-throated vireo	RP	I	I	I	I
Yellow-throated warbler	RP	M		M	M
Reptiles					
Coastal plain milk snake	SC	M	M	M	M
Eastern box turtle	SC	M	M	M	M
Eastern kingsnake	SC	M	M	M	M
Northern diamondback terrapin	SC	M		M	M
Spotted turtle	SC	M	M	M	M
Amphibians					
Carpenter frog	SC	M	M	M	M
Fowler's toad	SC	M	M	M	M
Marbled salamander	SC	M		M	M
Northern Spring Salamander	SC				M
Insects					
A geometrid moth <i>Idaea violacearia</i>	S1S3, G4			M	
A geometrid moth <i>Metarranthus sp 1</i>	S2, G3		M		
A noctuid moth <i>Apharetra dentata</i>	S2S3, G4		M	M	M
A noctuid moth <i>Macrochilo louisiana</i>	S2S3, G4			M	
A noctuid moth <i>Macrochilo sp 1</i>	S3, G3		M		
A noctuid moth <i>Meropleon cosmion</i>	S1S2, G4			M	

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Insects (continued)					
A noctuid moth <i>Chytonix sensilis</i>	S1S3, G4			M	
A slugmoth <i>Monoleuca semifascia</i>	S2S3, G4G5	M			
A spanworm <i>Itame sp 1</i>	S3, G3		M	M	M
Buchholz's gray <i>Hypomecis buchholzaria</i>	S3, G3G4		M	M	M
Carter's noctuid moth <i>Spartiniphaga carterae</i>	S2, G2G3		M	M	M
Chain fern borer moth <i>Papaipema stenocelis</i>	S3, G4	M		M	
Daecke's pyralid moth <i>Crambus daeckellus</i>	S1S3, G1G3		M		M
Doll's merolonche <i>Merolonche dolli</i>	S1S3, G3G4		M	M	M
Dotted skipper <i>Hesperia attalus</i>	SC, S2S3, G3G4	M	M	M	M
Granitosa fern moth <i>Callopietria granitosa</i>	S2S3, G4G5		M	M	
Hessel's hairstreak <i>Callophrys hesseli</i>	SC, S3S4, G3G4			M	M
Lemmer's pinion moth <i>Lithophane lemmeri</i>	S2, G3G4	M		M	M
Pine Barrens bluet <i>Enallagma recurvatum</i>	S3, G3		M	M	M
Pine Barrens zale <i>Zale sp 1</i>	S3, G3Q			M	M
Pink streak <i>Faronta rubripennis</i>	S3, G3G4	M	M		M
Pitcher plant borer moth <i>Papaipema appassionate</i>	S2S3, G4			M	
Placentia tiger moth <i>Grammia placentia</i>	S1S3, G4		M	M	M
Rare skipper <i>Problema bulenta</i>	S2, G2G3			M	
Scarlet bluet <i>Enallagma pictum</i>	S3, G3	M	M	M	M
Southern ptichodis <i>Ptichodis bistrigata</i>	S1S3, G3			M	M
The consort, or consors underwing <i>Catocala consors sorsconi</i>	S1S3, G4			M	
Two-spotted skipper <i>Euphyes bimacula</i>	SC, S3, G4		M	M	M
Fish					
American brook lamprey**	RP		X		
Banded sunfish**	RP	X	X	X	X
Black-banded sunfish	RP	X	X	X	X
Mud sunfish	RP	X	X	X	X

*Potential presence.

**Species are also recognized as target species of ecoregional concern by the Nature Conservancy – NJ Chapter.

SC: Species of special concern as identified within the state.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

S & G: Conservation Ranks defined in Appendix I

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

Table P5. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Species of Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Birds					
American black duck	RP	I	I	I	I
American woodcock	RP	I	I	I	I
Canada goose (Atlantic population)	RP	M	M	M	M
Northern bobwhite	RP	R	R	R	R
Virginia rail	RP	R	R	R	R
Wood duck	RP	M	M	M	M

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table P6. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Fish					
Ironcolor shiner	-	X			
Margined madtom	-		X		
Pirate perch	-	X	X	X	X
Shield darter	-				X

X: Species present. Management strategy not yet determined.

Table P7. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Regional Priority	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Mammals					
River otter	-	M	M	M	M
Birds					
Ruffed grouse	-	R	R	R	R
Sora rail	-	R	R	R	R

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table P8. Suites of Wildlife and their Location in the Pinelands Landscape

Common Name	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Mammals				
Forest Dwelling Bats	X	X	X	X
Birds				
Beach-nesting Birds			X	X
Interior-forest Cavity-nesters	X	X	X	X
Savannah and Forest-edge Habitat Cavity-nesters	X	X	X	X
Coastal High Marsh Birds	X		X	X
Coastal Low Marsh Birds	X		X	X
Colonial Waterbirds	X	X	X	X
Forest Passerines	X	X	X	
Forest Raptors	X	X	X	X
Freshwater Wetland Birds		X	X	

Suites of Wildlife and their Location in the Pinelands Landscape (continued)

Common Name	Southern Pinelands	Western Pinelands	Mullica River Watershed	Northern Pinelands
Birds (continued)				
Grassland Birds	X		X	
Migratory Shorebirds			X	X
Migratory Songbirds & Raptors		X	X	X
Scrub-shrub/Open Field (3-7 yrs) Birds	X	X	X	X
Early Succession (0 -3 years) Open Field Birds	X	X	X	X
Waterfowl	X	X	X	X
Reptiles				
Forest Dwelling Reptiles	X	X	X	X
Reptile Inhabitants of Wetland, Marsh and Bog	X	X	X	X
Reptiles Associated with water (lakes, ponds, streams)	X	X	X	X
Reptiles of Special Concern	X	X	X	X
Amphibians				
Amphibians of Special Concern	X	X	X	
Vernal Pool and Vernal Sinkhole Breeders	X	X	X	X
Insects				
Lepidoptera of Federal or State Legal Status	X	X	X	X
Lepidoptera of Special Concern	X	X	X	X
Odonata	X	X	X	X

X: Species occurs within the identified habitat.

E. Threats to Wildlife and Habitats of the Pinelands Landscape Region

The Pinelands Commission regulates development throughout much of the Pinelands Landscape; however, habitat loss and fragmentation remain the largest threat to wildlife in this region. Areas outside the regulatory boundaries of the Pinelands National Reserve (PNR) are at the highest risk of development, and large acreages of critical habitats continue to be modified by development in these areas. Within the PNR, development is directed into “Regional Growth” and “Rural Development” management areas and away from environmental sensitive areas, such as those within the “Forest Area” and “Preservation Area District”.

Changes in groundwater quantity and quality, along with inter-watershed transport of groundwater, threaten the productivity and health of amphibians and other wildlife. Research has shown that surface water quality decreases for Pinelands wildlife as pH levels rise in association with residential and commercial development and upland agriculture. This “buffering effect” has a negative impact on native Pinelands wildlife because it allows for non-Pinelands species to colonize sites that would normally be too acidic. The unlawful use of off-road vehicles on public and private lands also threatens sensitive species and habitats through destruction of vegetation, soil compaction, and direct mortality of rare reptiles and amphibians. Over-browsing by deer, fire suppression, and invasive insect infestations also represent significant threats to native Pinelands wildlife.

F. Conservation Zones, Assessments, and Strategies within the Pinelands Landscape

1. Southern Pinelands

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Associated Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Partnerships to Deliver Conservation*
- g. Monitoring Success*

a. Habitats

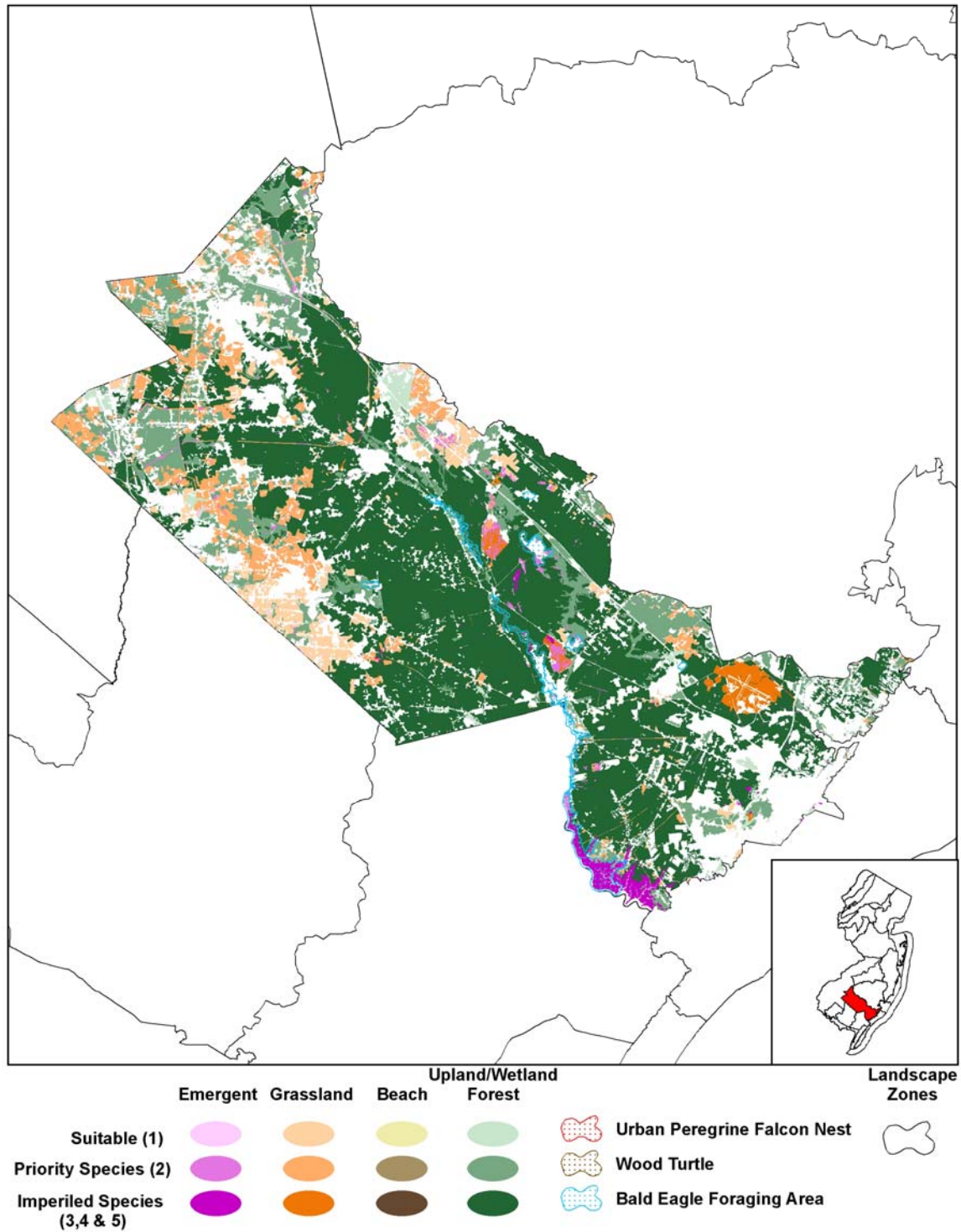
The Southern Pinelands Conservation Zone is primarily comprised of land within the Great Egg Harbor Watershed. Portions of Atlantic, Camden and Gloucester counties are contained in this zone (Figure 23). Deciduous forests, pitch pine-oak forests, and farmland characterize this landscape. The Pinelands National Reserve extends through this zone (72% of the total area), but 19% of this zone is classified as “urban” according to NJDEP’s 95/97 Land-Use, Land-Cover (LULC) data. Large state-owned land holdings in this area include Winslow WMA and Makepeace Lake WMA. The Atlantic City Airport is also located in the Southern Pinelands and contains extensive grassland bird habitat and possibly the largest global population of frosted elfin.

b. Wildlife of Greatest Conservation Need

The Southern Pinelands support one federal threatened, two state endangered, eight state threatened, 67 nongame species of conservation concern, and several important game species. Bald eagle are federally threatened, black skimmer, red-shouldered hawk, and upland sandpiper are state endangered, and state threatened species include barred owl, black-crowned night heron, Cooper’s hawk, red-headed woodpecker, northern pine snake, Pine Barrens treefrog, and frosted elfin. Special concern wildlife include cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, scrub-shrub/open field birds, reptiles, amphibians, and butterflies. In addition, summer populations of forest-dwelling bat species occur in the Southern Pinelands.

Large patches of deciduous upland forest and forested wetland provide important habitat for barred owls. The forests (including forested wetlands) also support bald eagle, Cooper’s hawk, and Pine Barrens treefrog populations; provide nesting sites for cavity-nesters, habitat for forest passerines, raptors; coastal plain milk snake, eastern box turtle, eastern kingsnake, spotted turtle, carpenter frog, Fowler’s toad, and marbled salamander populations. Freshwater wetland birds and colonial waterbirds inhabit Southern Pineland wetlands along the Great Egg Harbor River. The grasslands on the Atlantic City Airport property support the largest population of frosted elfins in the state, and contain breeding upland sandpipers and grasshopper sparrows. Tables P9 – P15 identify the species of greatest conservation need within this zone.

1 **Figure 23.** Critical landscape habitats within the Southern Pinelands conservation zone, as
 2 identified through the Landscape Map (v2).
 3



Wildlife Species and Associated Habitats of the Southern Pinelands

Table P9. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat				X**
Birds				
Bald eagle		X	X	X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

T: Federally threatened species.

X: Species occurs within the identified habitat.

Table P10. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Red-shouldered				X
Upland Sandpiper			X	

X: Species occurs within the identified habitat.

Table P11. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night heron		X		
Cooper's hawk				X
Grasshopper sparrow			X	
Red-headed woodpecker				X
Reptiles				
Northern pine snake			X	X
Amphibians				
Pine Barrens Treefrog		X		X
Invertebrates				
Frosted Elf			X	

X: Species occurs within the identified habitat.

Table P12. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				X*
Hoary bat				X*
Marsh rice rat		X		
Silver-haired bat				X*
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Black-throated green warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Cattle egret		X		
Cerulean warbler				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Common Barn owl			X	
Common nighthawk				
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Great blue heron		X		
Great crested flycatcher			X	
Great egret		X		
Green heron		X		
Hooded warbler				X
Horned lark			X	
Indigo bunting			X	
Kentucky warbler				X
King rail		X		
Least flycatcher				X
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Rose-breasted grosbeak				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Snowy egret		X		
Spotted sandpiper		X		
Tricolored heron		X		
Veery				X
Whip-poor-will				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Coastal plain milk snake				X
Eastern box turtle			X	X
Eastern kingsnake				X
Northern diamondback terrapin		X		
Spotted turtle			X	X
Amphibians				
Carpenter frog				X
Fowler's toad		X	X	X
Marbled salamander				X
Insects				
A slugmoth <i>Monoleuca semifascia</i>				X
Carter's noctuid moth <i>Spartiniphaga carterae</i>			X	
Dotted skipper <i>Hesperia attalus</i>			X	

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Insects (continued)				
Lemmer's pinion moth <i>Lithophane lemmeri</i>				X
Pink streak <i>Faronta rubripennis</i>				X
Scarlet bluet <i>Enallagma pictum</i>		X	X	
Fish				
Banded sunfish**	X			
Black-banded sunfish	X			
Mud sunfish	X			

*Potential presence.

**Species are also recognized as target species of ecoregional concern by the Nature Conservancy – NJ Chapter.

X: Species occurs within the identified habitat.

Table P13. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck		X		
American woodcock			X	X
Canada goose (Atlantic population)	X	X		
Northern bobwhite quail			X	X
Virginia Rail		X		
Wood duck		X		X

X: Species occurs within the identified habitat.

Table P14. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Ironcolor shiner	X
Pirate perch	X

X: Species occurs within the identified habitat.

Table P15. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Southern Pinelands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf.

The Southern Pinelands have extensive tracts of critical wildlife habitat, yet habitat loss and fragmentation still constitute major threats to wildlife. At its eastern edge, this landscape has been greatly modified by development in Egg Harbor and Galloway townships. Similar changes have taken place in Monroe Township in the northwestern portion of this zone. Nonetheless, important habitats still remain for barred owls, Pine Barrens treefrogs, northern pine snakes, frosted elfins, and other rare wildlife. The effects of deer and invasive insect species, such as the southern pine beetle, may have a considerable impact on forest health in the Southern Pinelands. Protecting large forest patches, maintaining intact wetlands and riparian corridors, and managing existing grasslands are the key components to proper habitat management within this conservation zone. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Protect, maintain, and/or enhance critical habitats as identified by the Landscape Project, and identify and protect critical aquatic habitat of endangered, threatened, and special concern fish species.
- Protect and restore characteristic Pinelands communities.
- Prevent, stabilize, and reverse declines of interior-forest raptors and passerines, and stabilize populations of northern pine snake, freshwater wetland birds, frosted elfin, rare reptiles and amphibians and rare dragonflies, damselflies, butterflies and moths.
- Prevent and stabilize declines of breeding grassland and scrub-shrub/open field wildlife populations.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Prevent illegal collection of rare reptiles and amphibians.
- Inventory, determine distribution, and monitor wildlife and fish species of greatest conservation need.
- Protect water quality and the availability of wetland habitats, including vernal pools.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public awareness and conservation.

1 e. Conservation Actions

Priority	Conservation Actions
Protect critical habitats identified by the Landscape Project and critical aquatic habitats	
1°	Identify critical core forests and assess their condition for forest-nesting birds and bald eagles, maintain information in the Landscape Project and Biotics database, and provide this information to the Pinelands Commission. Identify protection strategies (e.g. landowner incentives, acquisition) to maintain large core areas in perpetuity. Identify adjoining habitats that can be managed to enhance the total size of forest habitat. (<i>Protect habitat - Landscape Project</i>)
1°	Review and improve Landscape Project species habitat models as new land-use/land-cover data and data on species habitat requirements are available. (<i>Protect habitat - Landscape Project</i>)
1°	Act to protect, maintain, enhance, restore, and/or create habitat, as appropriate. Manage forests for large, more contiguous patches, but also maintain the diverse forest community types that currently, and historically, exist(ed) within the Pinelands. (<i>Silviculture - land management; Protect habitat – sprawl</i>)
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Protect habitat - Landscape Project; Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate this data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish</i>)
Protect and restore characteristic Pinelands communities	
1°	Determine the historic temporal and spatial patch diversity that once existed in the Pinelands and restore the dynamic nature of this ecosystem by developing management plans for state lands that incorporate the needs of Pinelands plants and animals. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify rare and unique Pinelands plant communities and increase protection for these areas. (<i>Protect habitat - Landscape Project</i>)
1°	Work with the Office of Natural Lands Management and the New Jersey Forest Fire Service to determine the historic, and possible future, role of fire in the creation and management of unique Pinelands communities. Research the different management techniques that might be used to mimic the historic role of fire in shaping this ecosystem and develop a strategy for how fire (through prescribed burning) can be used as a management tool in this region. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop management plans for utility line rights-of-way that favor the establishment and persistence of native, early successional Pinelands communities. (<i>Protect habitat - Landscape Project</i>)

1

Priority	Conservation Actions (continued)
Prevent, stabilize, and reverse declines of rare forest wildlife	
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagle. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify and implement best management practices for bald eagle, forest-interior passerine and raptor habitat.
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and alteration, impacts of roads, competition by invasive plants and animals, and how water quality degradation and contaminants affect rare species. (<i>Conserve Wildlife – invasives, contaminants, development; Evaluate restoration – roads</i>)
1°	Develop guidelines for recommended deer densities that are compatible with reversing declines of priority forest birds and increase deer harvest on public lands through special hunts and adjacent private lands through municipal deer management plans. (<i>Evaluate restoration – deer</i>)
1°	Protect northern pine snake populations from illegal collection. (<i>Protect wildlife – humans</i>)
1°	Investigate terrestrial habitat requirements for the northern pine snake, and developed a predictive model to identify pine snake habitat. Such a model should be developed with input from the Pinelands Commission so that it can be a fundamental tool used in their evaluation of development applications. The model will potentially identify critical life stage sites (e.g. nesting areas) that require additional protection from collection, disturbance, and destruction. (<i>Protect habitat - Landscape Project</i>)
1°	Develop and implement proactive habitat management/conservation plans for Pine Barrens treefrog. Such a plan should include ongoing surveys for this species to identify healthy populations and a scheme to protect habitats to connect populations and maintain viable metapopulations. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop management guidelines for private landowners with significant bald eagle, northern pine snake, Pine Barrens treefrog, cavity-nester, freshwater wetland bird, and raptor populations. (<i>Silviculture – land management</i>)
Prevent, stabilize, and reverse declines of grassland and scrub/shrub communities	
1°	Develop and implement BMPs for grasslands to improve habitat quality for grassland-dependent species. BMPs will be implemented on large patches such as at the Atlantic City Airport and along utility line rights-of-way. (<i>Conserve wildlife – rare wildlife</i>)
1°	Manage rights-of-way for frosted elfin and other grassland and scrub-shrub species with small area requirements. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Develop management guidelines for private landowners with significant grassland bird and scrub-shrub/open field bird populations. (<i>Enhance habitat – private lands</i>)
Prevent illegal collection of rare reptiles and amphibians	
1°	Protect critical sites (nesting, basking, gestation, dens) and implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes) and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
2°	Recruit and educate local law enforcement of endangered species laws and protect native wildlife from illegal collection (pine snakes), and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
Prevent, stabilize, and reverse declines of rare fish populations	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey.
1°	Determine carrying capacity of pinelands wetlands for breeding wood ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory and wintering waterfowl. Identify protection strategies to maintain existing waterfowl habitat. (<i>Protect habitat – game species</i>)
Identify and protect summer bat habitat	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat - humans</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
2°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
2°	Conduct state-wide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Protect habitat - Landscape Project; Monitor wildlife – long-term monitoring</i>)

Priority	Conservation Actions (continued)
Inventory and monitor wildlife	
1°	Survey suitable habitats to determine distribution of wildlife of greatest conservation need and establish baseline information. Repeat surveys for woodland raptors every four years and conduct searches for new frosted elfin populations. (<i>Protect habitat - Landscape Project</i>)
1°	Conduct surveys for dragonflies and damselflies in appropriate habitats throughout the Southern Pinelands. (<i>Enhance habitat – odonata</i>)
1°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, freshwater wetland bird, grassland bird, scrub-shrub/open field bird, and special concern reptile populations. (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and alteration, impacts of roads, competition by invasive plants and animals, and how water quality degradation and contaminants affect rare species. (<i>Conserve Wildlife - invasives, development; Evaluate restoration – roads</i>)
1°	Establish long-term monitoring programs for birds, reptiles, and amphibians and determine baseline abundance for these groups. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Monitor wildlife – fish</i>)
Protect water quality and maintain adequate buffers	
1°	Maintain ecologically relevant buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat – humans</i>)
1°	Identify and research water quality parameters for such species as T&E species, spotted turtle and special concern amphibian populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Conserve wildlife – rare wildlife</i>)
2°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
2°	Identify threats to vernal pools and devise strategies to protect vernal pool-dependent wildlife. (<i>Conserve wildlife – rare wildlife</i>)

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Priority	Conservation Actions (continued)
Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. <i>(Conserve wildlife – deer; Evaluate restoration - deer)</i>
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. <i>(Conserve wildlife – deer; Evaluate restoration - deer)</i>
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck.”). <i>(Conserve wildlife – deer)</i>
1°	Through surveys and public participation, identify areas where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. <i>(Conserve wildlife – invasives)</i>
1°	Work with public and private landowners to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. <i>(Conserve wildlife – invasives)</i>
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. <i>(Evaluate restoration – invasives)</i>
Promote public awareness and conservation	
1°	Develop and maintain educational materials (e.g. A Field Guide to Dragonflies and Damselflies of New Jersey) and viewing opportunities for the public. <i>(Education – humans)</i>

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f. Potential Partnerships to Deliver Conservation

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Private Landowners

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- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect bald eagles, frosted elfins, cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field bird nesting sites.

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- Utilize incentive programs that encourage the management of forests, grassland and scrub/shrub communities.
- Through incentive programs, encourage private landowners surrounding public natural lands to manage land for large forest patches in order to increase effective size and connectivity of forests.
- Encourage farmers to preserve farmland with conservation easements through partnerships with Green Acres, The Nature Conservancy, Trust for Public Lands, and local municipalities for the conservation of forests, grassland and scrub/shrub communities.
- Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
- Develop/maintain cooperative relationships with Atlantic City Airport to encourage the management of grasslands for species of conservation concern.
- Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions and harmful insect infestations. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
- Work with landowners to maintain/enhance existing habitats where listed and special concern fish species occur.
- In the context of landowner incentive programs such as LIP, Forestry Stewardship, etc., work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as the Pineland Preservation Alliance (PPA), NJ Audubon Society (NJAS), local land trusts, The Nature Conservancy – NJ Chapter (TNC), and NJ Conservation Foundation (NJCF) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
 - Collaborate with PPA, NJAS, NJCF, TNC, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
 - Continue volunteer-based summer bat concentration surveys.
- Collaborate with NJ Audubon Society to educate public on the effects of feral cats on wildlife species of conservation concern.
- Promote backyard habitat management for migratory raptors and passerines, and for vernal pools where appropriate.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with conservation organizations, Pinelands Preservation Alliance (PPA), The Nature Conservancy-NJ Chapter (TNC), NJ Audubon Society (NJAS), NJ Conservation Foundation (NJCF), and environmental, member-based organizations to protect and enhance habitats.
 - Work with TNC, NJAS, NJCF and environmental, member-based organizations to protect and enhance large tracts of contiguous forest, especially those adjacent to state (or otherwise permanently preserved) lands, beneficial to bald eagle, barred owl, cavity-nesters, and raptor nesting and foraging sites.
 - Work with PPA, TNC, NJAS and other environmental, member-based organizations to identify, manage, and protect bald eagle and raptor nesting and wintering areas.
 - Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants and invasive insects that can affect forest health.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Consult with conservation organizations to develop educational programs.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS) - NJ Field Office, US Department of Defense (DOD), and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats and protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) to collaborate with the Pinelands Commission to identify and protect important habitat for wildlife. When appropriate, change the boundaries of Pinelands Management Areas to better manage development around sensitive areas.
 - Identify valuable habitats for preservation and work with the DEP's Green Acres Program to pursue acquisition of these areas.
 - DFW to lead in protecting sensitive bald eagle and northern pine snake sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bald eagle and timber rattlesnake sites.

- Foster a relationship between the DFW and private/public landowners to restrict the use of off-road vehicles (ORVs) in critical wildlife habitats.
- DFW and USFWS to work with New Jersey's Forest Fire Service and the DEP's Office of Natural Lands Management to develop a strategy for reintroducing fire ecology into the Pinelands ecosystem through the use of prescribed burns.
- ENSP, Pinelands Commission, conservation organizations, and the DEP's Land Use Regulation Program to protect vernal pools and appropriately classify wetlands for spotted turtle and other vernal pool species.
- Expand efforts to create habitat and implement best management practices for frosted elfin, northern pine snake, cavity-nesters, forest passerines, freshwater wetland birds, raptors, and scrub-shrub birds on state lands and with other natural resource managers, county and municipal utility authorities, utility companies, and planners.
- Expand efforts to create habitat and implement best management practices for forest passerines and raptors, forest reptiles, and bald eagles on state lands and with other natural resource managers, county and municipal utility authorities and planners.
- DFW to work with DEP's Division of Watershed Management and other DEP agencies to establish ecologically relevant buffers for riparian and floodplain areas for forest passerines.
- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan as appropriate.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to lead in the development of specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with state and county mosquito commissions to prevent the use of deleterious insecticides and biological controls at known amphibian breeding sites.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with DEP's Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with the USFWS and Department of Defense to develop effective plans to eradicate invasive non-indigenous plants that are threatening critical wildlife habitats on federal and state lands and aquatic systems.

- DFW to lead in the development of educational materials for public and private landowners about forest-dependent and grassland-dependent wildlife and their habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Monitor abundance, productivity, distribution, and trends of frosted elfin, bald eagle, northern pine snake, cavity-nester, colonial waterbird, forest passerine, freshwater wetland birds, grassland bird, raptor, and scrub-shrub/open field bird populations.
- Monitor contaminant levels that may impact bald eagle populations.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the volunteer coverboard surveys.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Work with volunteers, private landowners, and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

2. Western Pinelands

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Associated Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Partnerships to Deliver Conservation*
- g. Monitoring Success*

a. Habitats

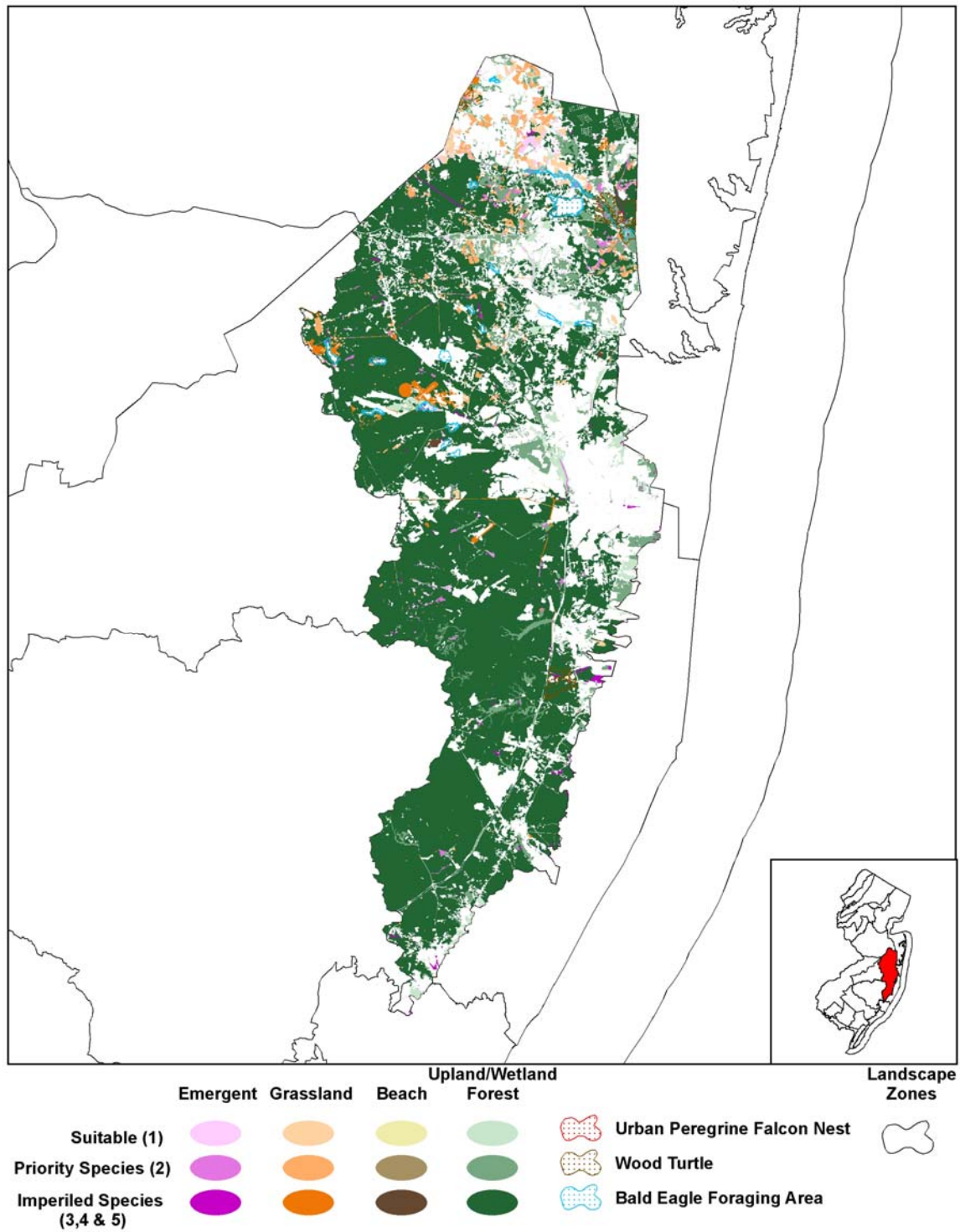
The Western Pinelands is the smallest of the four conservation zones in the Pinelands (Figure 24). Many of the characteristic pitch pine-oak forests, white cedar forested wetlands, marshes, sluggish acidic streams, and hardwood swamps of this zone are within the protected state lands of Greenwood Forest WMA and Brendan T. Byrne State Forest. Fort Dix Military Installation makes up roughly 15% of the total Pinelands Conservation Zone and contains habitat for many T&E wildlife species. This base is believed to support the nation's largest single population of the state-endangered arogos skipper (Lepidoptera). Because 84% of this zone falls within the Pinelands National Reserve, limited growth has occurred in large portions of the Western Pinelands.

b. Wildlife of Greatest Conservation Need

The Western Pinelands support two federal threatened, five state endangered, 10 state threatened, and 66 nongame species of conservation concern. The bald eagle and bog turtle are federal threatened; the red-shouldered hawk, vesper sparrow, timber rattlesnake, and arogos skipper are state endangered; and the barred owl, Cooper's hawk, red-headed woodpecker, northern pine snake, Pine Barrens treefrog, and silver-bordered fritillary are among the state threatened wildlife. Special concern wildlife include cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, scrub-shrub/open field birds, reptiles, amphibians, and butterflies. The northern bobwhite quail, wood duck, and Virginia rail are among seven regional priority game species that inhabit this zone. In addition, summer populations of forest-dwelling bat species occur in the Western Pinelands.

The pitch pine-oak forest provides habitat essential to northern pine snakes and timber rattlesnakes. The woodlands and wooded wetlands also support bald eagle, Pine Barrens treefrog, arogos skipper, and silver-bordered fritillary populations. These woodlands also provide nesting sites for cavity-nesters and habitat for forest passerines and raptors, forest-dwelling bats, coastal plain milk snake, eastern box turtle, eastern kingsnake, spotted turtle, carpenter frog, Fowler's toad, marbled salamander, and dotted skipper populations. A small, but stable, population of red-headed woodpecker inhabits the low-density forest stands on the New Lisbon Developmental Center and, sporadically, in Brendan T. Byrne State Forest and Greenwood WMA. Tables P16 – P22 identify the species of greatest conservation need within this zone.

1 **Figure 24.** Critical landscape habitats within the Western Pinelands conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Western Pinelands

Table P16. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat				X**
Birds				
Bald eagle		X	X	X
Reptiles				
Bog turtle		X		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

X: Species occurs within the identified habitat.

Table P17. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American Bittern		X		
Red-shouldered hawk				X
Vesper sparrow			X	
Reptiles				
Timber rattlesnake			X	X
Insects				
Arogos skipper		X		

X: Species occurs within the identified habitat.

Table P18. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Northern pine snake			X	X
Amphibians				
Eastern mud salamander				X
Pine Barrens Treefrog		X		X
Insects				
Silver-bordered fritillary		X		X

X: Species occurs within the identified habitat.

Table P19. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				X*
Hoary bat				X*
Marsh rice rat		X		
Silver-haired bat				X*
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Black-billed cuckoo				X
Black-throated green warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Common Barn owl			X	
Common nighthawk				
Dickcissel			X	
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Great blue heron		X		
Great crested flycatcher			X	
Great egret		X		
Green heron		X		
Hooded warbler				X
Horned lark			X	
Indigo bunting			X	
Kentucky warbler				X
King rail		X		
Louisiana waterthrush				X
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Spotted sandpiper		X		
Tricolored heron		X		
Veery				X
Whip-poor-will		X	X	
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Reptiles				
Coastal plain milk snake				X
Eastern box turtle			X	X
Eastern kingsnake				X
Spotted turtle			X	X
Amphibians				
Carpenter frog				X
Fowler's toad		X	X	X
Insects				
A geometrid moth <i>Metarranthis sp 1</i>				X
A noctuid moth <i>Apharetra dentata</i>				X
A noctuid moth <i>Macrochilo sp 1</i>			X	
A spanworm <i>Itame sp 1</i>				X
Buchholz's gray <i>Hypomecis buchholzaria</i>				X
Carter's noctuid moth <i>Spartiniphaga carterae</i>			X	

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Insects (continued)				
Daecke's pyralid moth <i>Crambus daeckellus</i>			X	
Doll's merolonche <i>Merolonche dolli</i>				X
Dotted skipper <i>Hesperia attalus</i>			X	
Granitosa fern moth <i>Callopietria granitosa</i>				X
Pine Barrens bluet <i>Enallagma recurvatum</i>		X		
Pink streak <i>Faronta rubripennis</i>				X
Placentia tiger moth <i>Grammia placentia</i>			X	
Scarlet bluet <i>Enallagma pictum</i>		X	X	
Two-spotted skipper <i>Euphyes bimacula</i>		X		
Fish				
American brook lamprey**	X			
Banded sunfish**	X			
Black-banded sunfish	X			
Mud sunfish	X			

*Potential presence.

**Species are also recognized as target species of ecoregional concern by the Nature Conservancy – NJ Chapter.

X: Species occurs within the identified habitat.

Table P20. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck		X		
American woodcock			X	X
Canada goose (Atlantic population)	X	X		
Northern bobwhite			X	X
Virginia Rail		X		
Wood duck		X		X

X: Species occurs within the identified habitat.

Table P21. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Margined madtom	X
Pirate perch	X

X: Species occurs within the identified habitat.

Table P22. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Western Pinelands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Western Pinelands Conservation Zone has extensive forest tracts that support forest interior species, yet intense development in Evesham, Medford, and Southampton townships have fragmented many contiguous forests. Even within the boundaries of the Pinelands National Reserve, development has resulted in the destruction of critical habitat for state threatened and endangered species. With the increased traffic associated with development in these townships, roads have become a major threat to wildlife on the western fringe of this zone. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, maintain, and/or enhance critical habitats as identified by the Landscape Project, and identify and protect critical aquatic habitat of endangered, threatened, and special concern fish species.
- Protect and restore characteristic Pinelands communities.
- Prevent, stabilize, and reverse declines of interior-forest raptors and passerines, and stabilize populations of Northern pine snake, freshwater wetland birds, silver-bordered fritillary, rare reptiles and amphibians and rare dragonflies, damselflies, moths and butterflies.
- Prevent and stabilize declines of breeding grassland and scrub-shrub/open field wildlife populations.
- Prevent, stabilize, and reverse declines of rare freshwater mussels and rare fish species.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Western Pinelands.
- Prevent illegal collection of rare reptiles and amphibians (including bog turtles and timber rattlesnake) and of Asiatic clams, which potentially damages native mussel populations through treading and disruption of habitat.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Protect water quality and the availability of wetland habitats, including vernal pools.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.

- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitats identified by the Landscape Project and critical aquatic habitats	
1°	Identify critical core forests and assess their condition for forest-nesting birds and bald eagles, maintain information in the Landscape Project and Biotics database, and provide this information to the Pinelands Commission. Identify protection strategies (e.g. landowner incentives, acquisition) to maintain large core areas in perpetuity. Identify adjoining habitats that can be managed to enhance the total size of forest habitat. (<i>Protect habitat - Landscape Project</i>)
1°	Develop guidelines for recommended deer densities compatible with enhancing forest health, generally by increasing deer harvest on public lands and adjacent private lands.
1°	Review and improve Landscape Project species habitat models as new land-use/land-cover data and data on species habitat requirements are available. (<i>Protect habitat - Landscape Project</i>)
1°	Incorporate freshwater mussel survey results into Riparian Landscape Project and determine critical areas for listed species. (<i>Protect habitat - mussels</i>)
1°	Act to protect, maintain, enhance, restore, and/or create habitat, as appropriate. Manage forests for large, more contiguous patches, but also maintain the diverse forest community types that currently, and historically, exist(ed) within the Pinelands. (<i>Silviculture - land management; Protect habitat - sprawl</i>)
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Protect habitat - Landscape Project, fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat - fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife - fish</i>)
Protect and restore characteristic Pinelands communities	
1°	Work with the Office of Natural Lands Management and the New Jersey Forest Fire Service to determine the historic, and possible future, role of fire in the creation and management of unique Pinelands communities. Research the different management techniques that might be used to mimic the historic role of fire in shaping this ecosystem and develop a strategy for how fire (through prescribed burning) can be used as a management tool in this region. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Determine the historic temporal and spatial patch diversity that once existed in the Pinelands and restore the dynamic nature of this ecosystem by developing management plans for state lands that incorporate the needs of Pinelands plants and animals. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify rare and unique Pinelands plant communities and increase protection for these areas. (<i>Protect habitat - Landscape Project</i>)
1°	Develop management plans for utility line rights-of-way that favor the establishment and persistence of native, early successional Pinelands communities. (<i>Protect habitat - Landscape Project</i>)
Prevent, stabilize, and reverse declines of rare forest wildlife	
1°	Work with the New Jersey Forest Service on a long-term management plan for Brendan T. Byrne State Forest and Greenwood WMA that will sustain both barred owl and red-headed woodpecker populations. (<i>Silviculture – land management</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagles. (<i>Conserve wildlife – rare wildlife</i>)
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and alteration, impacts of roads, competition by invasive plants and animals, and how water quality degradation and contaminants affect rare species. (<i>Conserve Wildlife - invasives, contaminants, development; Evaluate restoration - roads</i>)
1°	Develop guidelines for recommended deer densities that are compatible with reversing declines of priority forest birds and increase deer harvest on public lands through special hunts and adjacent private lands through municipal deer management plans. (<i>Evaluate restoration - deer</i>)
1°	Protect northern pine snake populations from illegal collection. (<i>Protect wildlife - humans</i>)
1°	Investigate terrestrial habitat requirements for the northern pine snake, and developed a predictive model to identify pine snake habitat. Such a model should be developed with input from the Pinelands Commission so that it can be a fundamental tool used in its evaluation of development applications. The model will potentially identify critical life-stage sites (e.g. nesting areas) that require additional protection from collection, disturbance, and destruction. (<i>Protect habitat - Landscape Project</i>)
1°	Develop and implement proactive habitat management/conservation plans for Pine Barrens treefrogs. Such a plan should include ongoing surveys for this species to identify healthy populations and a scheme to protect habitats to connect populations and maintain viable metapopulations. (<i>Conserve wildlife – rare wildlife</i>)

Priority	Conservation Actions (continued)
2°	Develop management guidelines for private landowners with significant bald eagle, northern pine snake, Pine Barrens treefrog, cavity-nester, freshwater wetland bird, and raptor populations. (<i>Silviculture – land management</i>)
2°	Identify and implement best management practices for bald eagle, forest-interior passerine and raptor habitat.
2°	Research the effects of prescribed burning and habitat fragmentation on northern pine snakes and timber rattlesnakes. (<i>Conserve wildlife – rare wildlife</i>)
Prevent, stabilize, and reverse declines of rare freshwater mussels and rare fish species	
1°	Protect water quality by maintaining larger buffers around wetlands, riparian and floodplain areas and minimizing destruction. (<i>Protect habitat - humans</i>)
1°	Seek Category One upgrades for streams with listed freshwater mussels. (<i>Protect habitat - mussels</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat - fish</i>)
2°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts.
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey.
1°	Determine carrying capacity of pinelands wetlands for breeding wood ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory and wintering waterfowl. Identify protection strategies to maintain existing waterfowl habitat. (<i>Protect habitat – game species</i>)
Identify and protect summer bat habitat	
1°	Conduct state-wide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Protect habitat - Landscape Project; Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
2°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
2°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat - humans</i>)

Priority	Conservation Actions (continued)
Prevent, stabilize, and reverse declines of grassland and scrub/shrub communities	
1°	Develop and implement best management practices (BMPs) for grasslands to improve habitat quality for grassland-dependent species. BMPs will be implemented on large grassland patches such as those at the Fort Dix Military Installation and along some utility line rights-of-way. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop management guidelines for private landowners with significant grassland bird and scrub-shrub/open field bird populations. (<i>Enhance habitat – private lands</i>)
2°	Manage silver-bordered fritillary habitat for proliferation of host vegetation and to retard succession. (<i>Conserve wildlife – rare wildlife</i>)
Inventory and monitor wildlife	
1°	Survey suitable habitats to determine distribution of wildlife of greatest conservation need and establish baseline information for monitoring. Repeat surveys for woodland raptors every four years. Locate undocumented timber rattlesnake hibernacula. Conduct searches for silver-bordered fritillary. Survey habitats and assess dotted skipper for conservation status. (<i>Protect habitat - Landscape Project</i>)
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and alteration, impacts of roads, competition by invasive plants and animals, and how water quality degradation and contaminants affect rare species. (<i>Conserve Wildlife - invasives, , development; Evaluate restoration - roads</i>)
1°	Conduct surveys for dragonflies and damselflies in appropriate habitats throughout the Western Pinelands. (<i>Enhance habitat - odonata</i>)
1°	Conduct surveys in suitable, previously un-surveyed areas to determine if listed or special concern freshwater mussel species are present. Repeat surveys every four years to monitor populations. (<i>Protect habitat - mussels</i>)
1°	Conduct surveys for the eastern mud salamander at historic sites and evaluate its use of wetlands and wetland buffers. (<i>Conserve wildlife – rare wildlife</i>)
1°	Establish long-term monitoring programs for birds, reptiles, and amphibians and determine baseline abundance for these groups. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Monitor wildlife - fish</i>)
2°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, freshwater wetland bird, grassland bird, scrub-shrub/open field bird, and special concern reptile populations. (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
2°	Survey suitable habitats in SW Branch of Rancocas Creek and associated waterways to determine triangle floater distribution. (<i>Protect habitat - mussels</i>)

Priority	Conservation Actions (continued)
Prevent illegal collection of rare amphibians and reptiles, and Asiatic clams	
1°	Protect critical sites (nesting, basking, gestation, dens) and implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (including bog turtles, timber rattlesnakes), persecution (timber rattlesnakes), and human disturbance (off-road vehicles, clam harvesting). (<i>Protect wildlife – humans, recreational vehicles</i>)
2°	Recruit and educate local law enforcement of endangered species laws and protect native wildlife from illegal collection (including bog turtles and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
Protect water quality and maintain adequate buffers	
1°	Maintain ecologically relevant buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat - humans</i>)
2°	Investigate the impact of land-use patterns on Pine Barrens treefrog. (<i>Conserve wildlife – rare wildlife</i>)
2°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
2°	Identify threats to vernal pools and devise strategies to protect vernal pool-dependent wildlife. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify and research water quality parameters for such species as T&E species, spotted turtle and special concern amphibian populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Conserve wildlife – rare wildlife</i>)
Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck.”). (<i>Conserve wildlife – deer</i>)
1°	Through surveys and public participation, identify areas where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)

Priority	Conservation Actions (continued)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Evaluate restoration – invasives</i>)
2°	Work with public and private landowners to employ physical, chemical, or biological control measures, or a combination of these, in areas identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife - invasives</i>)
Promote public awareness and conservation	
1°	Develop management guidelines for private landowners with significant bald eagle, timber rattlesnake, northern pine snake, Pine Barrens treefrog, cavity-nester, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird populations.
1°	Develop and maintain educational materials (e.g. A Field Guide to Dragonflies and Damselflies of New Jersey) and viewing opportunities for the public. (<i>Education - humans</i>)
1°	Identify and implement best management practices to enhance the Western Pinelands as a significant habitat for forest-interior species and bald eagles.
1°	Develop a field guide to New Jersey's freshwater mussel species to assist in promoting public education and increase awareness of New Jersey's native freshwater mussel fauna. (<i>Education - humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education - humans</i>)

f. Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect bald eagle, red-headed woodpecker, cavity-nester, forest passerine, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird nesting sites.
 - Utilize incentive programs that encourage the management of forests, grassland and scrub/shrub communities.
 - Through incentive programs, encourage private landowners surrounding public natural lands to manage land for large forest patches in order to increase effective size and connectivity of forests.
 - Utilize the Landowner Incentive Program to protect water quality and riparian habitat in areas where rare mussels occur.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.

- Encourage farmers to preserve farmland with conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of forests, grassland and scrub/shrub communities.
- Work with landowners to maintain/enhance riparian areas through stream bank restoration and planting native vegetation.
- Work with landowners to protect water quality by minimizing use of fertilizers and pesticides.
- Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions and harmful insect infestations; and to develop effective control or eradication measures to protect critical wildlife habitats.
- Work with landowners to maintain/enhance existing habitats where listed and special concern fish species occur.
- As part of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups (Pineland Preservation Alliance (PPA), NJ Audubon Society (NJAS), local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation (NJCF)) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with PPA, NJAS, NJCF, TNC, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas.
 - Continue volunteer-based summer bat concentration surveys.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
- Collaborate with NJAS to educate public on the effects of feral cats on wildlife species of conservation concern.
- Promote backyard habitat management for migratory raptors and passerines, and for vernal pools where appropriate.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Collaborate with the National Native Mussel Conservation Committee and other experts to develop best management practices for areas with listed and special concern species.
- Work with American Museum of Natural History to maintain existing NY/NJ freshwater mussel web site.

- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with conservation organizations such as the Pinelands Preservation Alliance (PPA), The Nature Conservancy-NJ Chapter (TNC), NJ Audubon Society (NJAS), and NJ Conservation Foundation (NJCF) and other environmental, member-based organizations to protect and enhance habitats.
 - Work with PPA, TNC, NJAS, NJCF and environmental, member-based organizations to protect and enhance large tracts of contiguous forest, especially those adjacent to state lands, beneficial to bald eagles, barred owls, cavity-nesters, and raptor nesting and foraging sites.
 - Work with TNC, NJAS and other environmental, member-based organizations to manage and protect bald eagle and raptor nesting and wintering areas.
 - Work with PPA, TNC, NJAS, and other environmental, member-based organizations to protect and enhance sites hosting significant populations of rare dragonflies, damselflies, moths and butterflies on conservation lands.
 - Conduct habitat surveys to determine geographic distribution and severity of invasive non-indigenous plant and insect invasions that can affect forest health.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participating in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Consult with conservation organizations to develop educational programs.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS) - NJ Field Office, US Department of Defense (DOD), and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats; and protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) to collaborate with the Pinelands Commission to identify and protect important habitat for wildlife. When appropriate, change the boundaries of Pinelands Management Areas to better manage development around sensitive areas.
 - Identify valuable habitats for preservation and work with the DEP's Green Acres Program to pursue acquisition of these important areas.
 - DFW to work with the DEP's Division of Parks and Forestry (DPF) to create a management plan for Brendan T. Byrne State Forest.
 - DFW and USFWS to work with New Jersey's Forest Fire Service and the DEP's Office of Natural Lands Management to develop a strategy for introducing fire ecology back into the Pinelands ecosystem through the use of prescribed burns.

- DFW to work with local law enforcement officers to develop a plan to protect sensitive bald eagle and pine snake sites from disturbance and timber rattlesnake and northern pine snake breeding sites from illegal collection.
- DFW will lead in the prevention of the illegal harvesting of Asian clams, which potentially damages native mussel populations through treading and disruption of habitat.
- DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bald eagle sites.
- DFW to work with neighboring state fish and wildlife agencies to radio-track Indiana bats that disperse across state boundaries.
- DFW to work with the Pinelands Commission to protect sensitive areas around timber rattlesnake hibernacula.
- ENSP, conservation organizations, DEP's Land Use Regulation Program, and the Pinelands Commission to work together to protect vernal pools and appropriately classify wetlands for spotted turtle and special concern amphibian populations.
- Foster a relationship between the DFW and private/public landowners to restrict the use of off-road vehicles (ORVs) in critical wildlife habitats.
- Expand efforts to create habitat and implement best management practices for northern pine snake, cavity-nester, forest passerines, freshwater wetland birds, raptors, and scrub-shrub birds on state lands with NJDFW and NJDPF, and with natural resource managers, county and municipal utility authorities and planners.
- DFW to encourage ecologically relevant buffers for important riparian and floodplain areas for forest passerines, amphibians and reptiles, freshwater mussels, and invertebrates with the Pinelands Commission, and the DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels.
- DFW to work with the DEP's Division of Watershed Management, the DEP's Bureau of Water Monitoring and Standards, and the Pinelands Commission to recommend stream classification upgrades in stream segments where listed mussel species occur.
- DFW to work with federal military bases to develop habitat management plans to maintain arogos skipper habitats by impeding succession with controlled burns and scheduled mowing.
- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan as appropriate.
- DFW to lead in the development of specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.

- DFW and USDA-NRCS to collaborate with SADC and NJ Farm Bureau to implement deer management plans on farmland, particularly in high deer-density areas.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with state and county mosquito commissions to prevent the use of deleterious insecticides and biological controls at known amphibian breeding sites.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with DEP's Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with the USFWS and Department of Defense to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- DFW to lead in the development of educational materials for public and private landowners about forest-dependent and grassland-dependent wildlife and their habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by federal, state, and local planning agencies.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Monitor abundance, productivity, distribution, and trends of bald eagle, red-headed woodpecker, timber rattlesnake, cavity-nester, colonial waterbird, forest passerine, freshwater wetland birds, grassland bird, raptor, and scrub-shrub/open field bird populations.
- Monitor contaminant levels that may impact bald eagle populations.
- Monitor population trends, breeding success, and habitat of timber rattlesnake and northern pine snake.
- Routinely monitor the population trends of special concern reptiles and special concern amphibians.
- Conduct surveys for listed and special concern freshwater mussel species every four years to monitor populations.

- 1 • Monitor populations of breeding, migratory and wintering waterfowl of conservation
2 concern.
- 3 • Work with volunteers, private landowners and conservation groups to monitor the success of
4 eradication/control projects that target invasive non-indigenous plants.
- 5 • Continue to monitor deer densities and deer harvest data.
- 6 • Develop indicator metrics for monitoring forest health and implement at the scale necessary
7 to monitor effectiveness of deer management strategies.
- 8
- 9
- 10

3. Mullica River Watershed

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

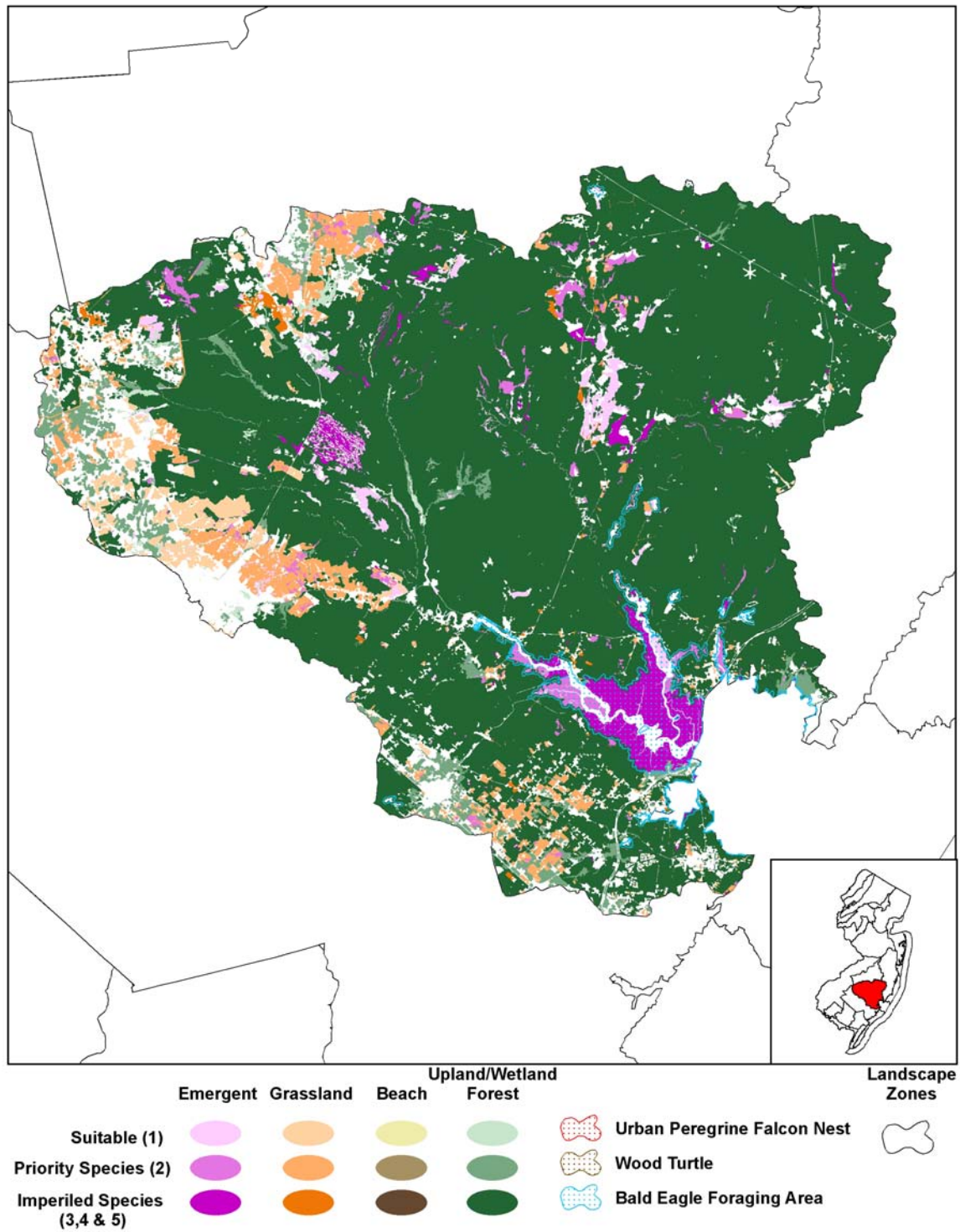
The Mullica River Watershed is the most pristine conservation zone in the Pinelands landscape region (Figure 25). This zone is almost completely within Pinelands National Reserve (98%) and over half of it is contained within the Preservation Management Area of the Pinelands. As a result, many of the pine-oak forests and Atlantic white cedar swamps in the Mullica River Watershed exist as large contiguous tracts. Only 6% of this zone is classified as “urban” based on the NJDEP’s 95/97 Land-use, Land-cover (LULC) data. Tidal marshes occur along the eastern fringe of this zone at the mouth of the Mullica River. Penn State Forest and the Bass River State Forest are conservation areas of opportunity in the Mullica River Watershed.

b. Wildlife of Greatest Conservation Need

The Mullica River Watershed supports one federal threatened, five state endangered, seven state threatened, and 78 nongame species of conservation concern. The federal threatened species is the bald eagle. The state endangered species in this zone are the foraging black skimmer, red-shouldered hawk, corn snake, timber rattlesnake, and arogo skipper. Barred owl, black-crowned night-heron, Cooper’s hawk, red-headed woodpecker, northern pine snake, osprey, and Pine Barrens treefrog are state threatened species. Special concern wildlife include forest passerines, raptors, scrub-shrub/open field birds, reptiles, and amphibians. Regional priority game species in this zone include the American black duck, northern bobwhite quail, and Virginia rail. In addition, summer populations of forest-dwelling bat species occur in the Mullica River Watershed.

The pitch pine-oak forests are home to bald eagle, red-headed woodpecker, forest-dwelling bats, corn snake, northern pine snake, timber rattlesnake, wood turtle, and Pine Barrens treefrog populations; and cavity-nester, colonial waterbird, forest passerine, raptor, and shrub-scrub/open field bird communities. Wetlands and open water along the Mullica River are habitat for foraging osprey, bald eagles, black skimmers, colonial waterbirds, northern diamondback terrapins, and special concern amphibians. Certain species of amphibians, such as carpenter frogs and Pine Barren treefrogs, have adapted to the acidity of the Pinelands cedar water. Tables P23 – P29 identify the species of greatest conservation need within this zone.

1 **Figure 25.** Critical landscape habitats within the Mullica River Watershed conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Mullica River Watershed

Table P23. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat				X**
Birds				
Bald eagle		X	X	X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

X: Species occurs within the identified habitat.

Table P24. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Black skimmer		X		
Red-shouldered hawk				X
Reptiles				
Corn snake				X
Timber rattlesnake				X
Insects				
Arogos skipper		X	X	

X: Species occurs within the identified habitat.

Table P25. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night heron		X		
Cooper's hawk				X
Osprey		X		
Red-headed woodpecker				X
Reptiles				
Northern pine snake			X	X
Wood turtle				X
Amphibians				
Eastern mud salamander				X
Pine Barrens Treefrog			X	X

X: Species occurs within the identified habitat.

Table P26. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				
Hoary bat				X*
Marsh rice rat		X		
Silver-haired bat				X*
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blue-winged warbler				X
Broad-winged hawk				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Brown thrasher				X
Common Barn owl			X	
Common nighthawk				
Dickcissel			X	
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Great blue heron		X		
Great crested flycatcher			X	
Great egret		X		
Green heron		X		
Hooded warbler				X
Indigo bunting			X	
Kentucky warbler				X
King rail		X		
Least flycatcher				X
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Prothonotary warbler				X
Rose-breasted grosbeak				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Snowy egret		X		
Spotted sandpiper		X		
Tricolored heron		X		
Veery				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Coastal plain milk snake				X
Eastern box turtle			X	X
Eastern kingsnake				X
Northern diamondback terrapin		X		
Spotted turtle			X	X
Amphibians				
Carpenter frog				X
Fowler's toad		X	X	X
Marbled salamander				X
Insects				
A geometrid moth <i>Idaea violacearia</i>				X
A noctuid moth <i>Apharetra dentata</i>				X
A noctuid moth <i>Macrochilo louisiana</i>			X	

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Insects (continued)				
A noctuid moth <i>Meropleon cosmion</i>		X		
A spanworm <i>Itame sp 1</i>				X
Buchholz's gray <i>Hypomecis buchholzaria</i>				X
Carter's noctuid moth <i>Spartiniphaga carterae</i>			X	
Chain fern borer moth <i>Papaipema stenocelis</i>				X
Doll's merolonche <i>Merolonche dolli</i>				X
Dotted skipper <i>Hesperia attalus</i>			X	
Granitosa fern moth <i>Callopietria granitosa</i>				X
Hessel's hairstreak <i>Callophrys hesseli</i>				X
Lemmer's pinion moth <i>Lithophane lemmeri</i>				X
Pine Barrens bluet <i>Enallagma recurvatum</i>		X		
Pine Barrens zale <i>Zale sp 1</i>				X
Pitcher plant borer moth <i>Papaipema appassionate</i>		X		
Placentia tiger moth <i>Grammia placentia</i>			X	
Rare skipper <i>Problema bulenta</i>				X
Scarlet bluet <i>Enallagma pictum</i>		X	X	
Southern ptichodis <i>Ptichodis bistrigata</i>			X	
The consort, or consors underwing <i>Catocala consors sorsconi</i>				X
Two-spotted skipper <i>Euphyes bimacula</i>		X		
Fish				
Banded sunfish**	X			
Black-banded sunfish	X			
Mud sunfish	X			

*Potential presence.

**Species are also recognized as target species of ecoregional concern by the Nature Conservancy – NJ Chapter.

X: Species occurs within the identified habitat.

Table P27. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck		X		
American woodcock			X	X
Canada goose (Atlantic population)	X	X		
Northern bobwhite			X	X
Virginia rail		X		
Wood duck		X		X

X: Species occurs within the identified habitat.

Table P28. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Pirate perch	X

X: Species occurs within the identified habitat.

Table P29. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Mullica River Watershed

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Habitat-specialists in the Mullica River Watershed are vulnerable to any upland development and habitat fragmentation by roads. Development and upland agriculture in the northwestern portion of this zone contribute to water quality degradation; pH increases and mounting demands on the Pinelands groundwater supply can lead to the loss of wetland habitats. Contaminants continue to plague bald eagles. Finally, disturbance and encroachment from recreational activities threaten sensitive wildlife in the Pinelands. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, maintain, and/or enhance critical habitats as identified by the Landscape Project and identify and protect critical aquatic habitat of endangered, threatened, and special concern fish species.
- Prevent, stabilize, and reverse declines of interior-forest raptors and passerines, and stabilize populations of corn snake, Northern pine snake, freshwater wetland birds, rare reptiles and amphibians and rare dragonflies, damselflies, moths and butterflies.
- Protect and restore characteristic Pinelands communities.
- Prevent and stabilize declines of breeding grassland and scrub-shrub/open field wildlife populations.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Prevent illegal collection of rare reptiles and amphibians.

- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Mullica River Watershed.
- Protect water quality and the availability of wetland habitats, including vernal pools.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitats identified by the Landscape Project and critical aquatic habitats	
1°	Identify critical core forests and assess their condition for forest-nesting birds and bald eagles, maintain information in the Landscape Project and Biotics database, and provide this information to the Pinelands Commission. Identify protection strategies (e.g. landowner incentives, acquisition) to maintain large core areas in perpetuity. Identify adjoining habitats that can be managed to enhance the total size of forest habitat.
1°	Develop guidelines for recommended deer densities compatible with enhancing forest health, generally by increasing deer harvest on public lands and adjacent private lands.
1°	Act to protect, maintain, enhance, restore, and/or create habitat, as appropriate. Manage forests for large, more contiguous patches, but also maintain the diverse forest community types that currently, and historically, exist(ed) within the Pinelands. (<i>Silviculture - land management; Protect habitat - sprawl</i>)
1°	Review and improve Landscape Project species habitat models as new land-use/land-cover data and data on species habitat requirements are available. (<i>Protect habitat - Landscape Project</i>)
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Protect habitat - Landscape Project, fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat - fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife - fish</i>)
2°	Model suitable northern diamondback terrapin nesting areas using U.S. Fish and Wildlife Service habitat suitability index models. (<i>Protect habitat - Landscape Project</i>)

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Priority	Conservation Actions (continued)
Protect and restore characteristic Pinelands communities	
1°	Work with the Office of Natural Lands Management and the New Jersey Forest Fire Service to determine the historic, and possible future, role of fire in the creation and management of unique Pinelands communities. Research the different management techniques that might be used to mimic the historic role of fire in shaping this ecosystem and develop a strategy for how fire (through prescribed burning) can be used as a management tool. (<i>Conserve wildlife – rare wildlife</i>)
1°	Determine the historic temporal and spatial patch diversity that once existed in the Pinelands and restore the dynamic nature of this ecosystem by developing management plans for state lands that incorporate the needs of Pinelands plants and animals. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify rare and unique Pinelands plant communities and increase protection for these areas. (<i>Protect habitat - Landscape Project</i>)
1°	Develop management plans for utility line rights-of-way that favor the establishment and persistence of native, early successional Pinelands communities. (<i>Enhance habitat – private lands</i>)
Prevent, stabilize, and reverse declines of rare forest wildlife	
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagles. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify and implement best management practices for bald eagle, forest-interior passerine and raptor habitat.
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and alteration, impacts of roads, competition by invasive plants and animals, and how water quality degradation and contaminants affect rare species. (<i>Conserve Wildlife - invasives, contaminants, development; Evaluate restoration - roads</i>)
1°	Develop guidelines for recommended deer densities that are compatible with reversing declines of priority forest birds and increase deer harvest on public lands through special hunts and adjacent private lands through municipal deer management plans. (<i>Evaluate restoration - deer</i>)
1°	Investigate terrestrial habitat requirements for the northern pine snake, and developed a predictive model to identify pine snake habitat. Such a model should be developed with input from the Pinelands Commission so that it can be a fundamental tool used in their evaluation of development applications. The model will potentially identify critical life-stage sites (e.g. nesting areas) that require additional protection from collection, disturbance, and destruction. (<i>Protect habitat - Landscape Project</i>)

Priority	Conservation Actions (continued)
1°	Develop and implement proactive habitat management/conservation plans for Pine Barrens treefrogs. Such a plan should include ongoing surveys for this species to identify healthy populations and a scheme to protect habitats that connect populations and maintain viable metapopulations. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop management guidelines for private landowners with significant bald eagle, northern pine snake, Pine Barrens treefrog, cavity-nester, freshwater wetland bird, and raptor populations. (<i>Silviculture – land management</i>)
2°	Research the effects of prescribed burning and habitat fragmentation on corn snakes and northern pine snakes.
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey.
1°	Determine carrying capacity of pinelands wetlands for breeding wood ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory and wintering waterfowl. Identify protection strategies to maintain existing waterfowl habitat. (<i>Protect habitat – game species</i>)
Identify and protect summer bat habitat	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Develop an Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
2°	Conduct state-wide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Protect habitat - Landscape Project; Monitor wildlife – long-term monitoring</i>)
2°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
2°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat - humans</i>)
Prevent, stabilize, and reverse declines of grassland and scrub/shrub communities	
1°	Develop and implement BMPs for grasslands to improve habitat quality for grassland-dependent species. BMPs will be implemented on large grassland patches and along utility line rights-of-way. (<i>Conserve wildlife – rare wildlife</i>)
2°	Develop management guidelines for private landowners with significant grassland bird and scrub-shrub/open field bird populations. (<i>Conserve wildlife – rare wildlife</i>)

Priority	Conservation Actions (continued)
Prevent, stabilize, and reverse declines of rare fish species	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat - fish</i>)
Prevent illegal collection of rare reptiles and amphibians	
1°	Locate and protect hibernacula for corn snakes, timber rattlesnakes, and northern pine snakes. (<i>Protect habitat - humans</i>)
1°	Protect critical sites (nesting, basking, gestation, dens) and implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes) and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
2°	Recruit and educate local law enforcement of endangered species laws and protect native wildlife from illegal collection (including corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
2°	Protect corn snake, northern pine snake, timber rattlesnake, and Pine Barren treefrog populations from illegal collection. (<i>Protect wildlife - humans</i>)
Inventory and monitor wildlife	
1°	Survey suitable habitats to identify unidentified populations of arogos skipper. Develop a management plan to maintain and enhance habitat for arogos skipper using controlled burns. (<i>Protect habitat - Landscape Project</i>)
1°	Survey suitable habitats to determine distribution of wildlife of greatest conservation need and establish baseline information. Repeat surveys for woodland raptors every four years. (<i>Protect habitat - Landscape Project</i>)
1°	Conduct surveys for dragonflies and damselflies in appropriate habitats throughout the Mullica River Watershed. (<i>Enhance habitat - odonata</i>)
1°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, freshwater wetland bird, grassland bird, scrub-shrub/open field bird, and special concern reptile populations. (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
1°	Establish long-term monitoring programs for birds, reptiles, and amphibians and determine baseline abundance for these groups. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Monitor wildlife - fish</i>)
2°	Close existing northern diamondback terrapin harvesting season.
Protect water quality and maintain adequate buffers	
1°	Maintain ecologically relevant buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat - humans</i>)
2°	Identify and research water quality parameters for such species as northern diamondback terrapin, spotted turtle and special concern amphibian populations.

Priority	Conservation Actions (continued)
2°	Investigate the impact of land-use patterns on Pine Barrens treefrog. <i>(Conserve wildlife – rare wildlife)</i>
2°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. <i>(Conserve wildlife – rare wildlife)</i>
2°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulatory database and Landscape Project. <i>(Protect habitat – Landscape Project)</i>
2°	Identify threats to vernal pools and devise strategies to protect vernal pool-dependent wildlife. <i>(Conserve wildlife – rare wildlife)</i>
Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. <i>(Conserve wildlife – deer; Evaluate restoration - deer)</i>
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. <i>(Conserve wildlife – deer; Evaluate restoration - deer)</i>
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck.”). <i>(Conserve wildlife – deer)</i>
1°	Through surveys and public participation, identify areas where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. <i>(Conserve wildlife – invasives)</i>
1°	Work with public and private landowners to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. <i>(Conserve wildlife - invasives)</i>
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. <i>(Evaluate restoration – invasives)</i>
Promote public awareness and conservation	
1°	Identify and implement best management practices to maintain and enhance the Mullica River Watershed as a significant habitat for forest-interior species and bald eagles.

Priority	Conservation Actions (continued)
2°	Develop and maintain educational materials (e.g. A Field Guide to Dragonflies and Damselflies of New Jersey) and viewing opportunities for the public. <i>(Education - humans)</i>
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. <i>(Education - humans)</i>

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect bald eagle, arogos skipper, and rare snake habitat and cavity-nester, forest passerine, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird nesting sites.
 - Utilize incentive programs that encourage the management of forests, grassland and scrub/shrub communities.
 - Through incentive programs, encourage private landowners surrounding public natural lands to manage land for large forest patches in order to increase effective size and connectivity of forests.
 - Encourage farmers to preserve farmland with conservation easements through partnerships with DEP Green Acres Program, the Nature Conservancy, Trust for Public Lands, and local municipalities for the conservation of forests, grassland and scrub/shrub communities.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
 - Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions and harmful insect infestations. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
 - Work with landowners to maintain/enhance existing habitats where listed and special concern fish species occur.
 - As part of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups (Pineland Preservation Alliance (PPA), New Jersey Audubon Society (NJAS), local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation (NJCF)) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with PPA, NJAS, NJCF, TNC, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots

- (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
- Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas.
- Continue volunteer-based summer bat concentration surveys.
- Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
- Collaborate with NJ Audubon Society to educate public on the effects of feral cats on wildlife species of conservation concern.
- Promote backyard habitat management for migratory raptors and passerines, and for vernal pools where appropriate.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with conservation organizations such as the Pinelands Preservation Alliance (PPA), The Nature Conservancy-NJ Chapter (TNC), NJ Audubon Society (NJAS), NJ Conservation Foundation (NJCF), and other environmental, member-based organizations to protect and enhance habitats.
 - Work with TNC, NJAS, NJCF and environmental, member-based organizations to protect and enhance large tracts of contiguous forest, especially those adjacent to state lands, beneficial to bald eagle, barred owl, cavity-nesters, and raptor nesting and foraging sites.
 - Work with PPA, TNC, NJAS and other environmental, member-based organizations to manage and protect bald eagle and raptor nesting and wintering areas.
 - Protect and enhance sites hosting significant populations of rare dragonflies, damselflies, moths, and butterflies on conservation lands.
 - Conduct habitat surveys to determine geographic distribution and severity of invasive non-indigenous plant and insect invasions that can affect forest health.
 - Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Consult with conservation organizations to develop educational programs.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's Natural Resources Conservation Service (NRCS), US Fish and

Wildlife Service (USFWS) - NJ Field Office, US Department of Defense (DOD), and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.

- NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) to collaborate with the Pinelands Commission to identify and protect important wildlife habitat. When appropriate, change the boundaries of Pinelands Management Areas to better manage development around sensitive areas.
- Identify valuable habitats for preservation and work with the DEP's Green Acres Program to pursue acquisition of these important areas.
- DFW and USFWS to work with New Jersey's Forest Fire Service and the DEP's Office of Natural Lands Management to develop a strategy for introducing fire ecology back into the Pinelands ecosystem through the use of prescribed burns.
- DFW to lead in the protection of bald eagle, barred owl, cavity-nester, and raptor nesting and foraging sites.
- DFW to work with the local law enforcement officers to protect sensitive corn snake, timber rattlesnake, and northern pine snake sites from disturbance and collection.
- Foster a relationship between the DFW and private/public landowners to restrict the use of off-road vehicles in critical wildlife habitats.
- ENSP, conservation organizations, DEP's Land Use Regulation Program, and the Pinelands Commission to work together to protect vernal pools and critical habitats for corn snakes, timber rattlesnakes and northern pine snakes.
- DFW to share site information and expertise with state and federal law enforcement to increase surveillance of corn snake, timber rattlesnake, and northern pine snake sites.
- DFW to work with neighboring state fish and wildlife agencies to radio-track Indiana bats dispersing across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan as appropriate.
- Expand efforts to create habitat and implement best management practices for frosted elfins, northern pine snakes, cavity-nesters, forest passerines, freshwater wetland birds, raptors, and scrub-shrub birds on state lands and with other natural resource managers, county and municipal utility authorities, utility companies, and planners.
- DFW will take lead on developing specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with state and county mosquito commissions to prevent the use of deleterious insecticides and biological controls at known amphibian breeding sites.

- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with the Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with the USFWS and Department of Defense to develop effective plans to eradicate invasive non-indigenous plants that are threatening critical wildlife habitats on federal and state lands and aquatic systems.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- Continue protection measures for northern diamondback terrapin with the Bureau of Law Enforcement by requiring excluders on commercial crab traps in small creeks and lagoons.
- DFW to lead in the development of educational materials for public and private landowners about forest-dependent and grassland-dependent wildlife and their habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through on-site programs and wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Monitor abundance, productivity, distribution, and trends of bald eagle, corn snake, timber rattlesnake, northern pine snake, Pine Barrens treefrog, cavity-nester, colonial waterbird, forest passerine, and scrub-shrub/open field bird populations.
- Monitor contaminant levels that may impact bald eagle populations.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the volunteer coverboard surveys.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Work with volunteers, private landowners, and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

4. Northern Pinelands

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

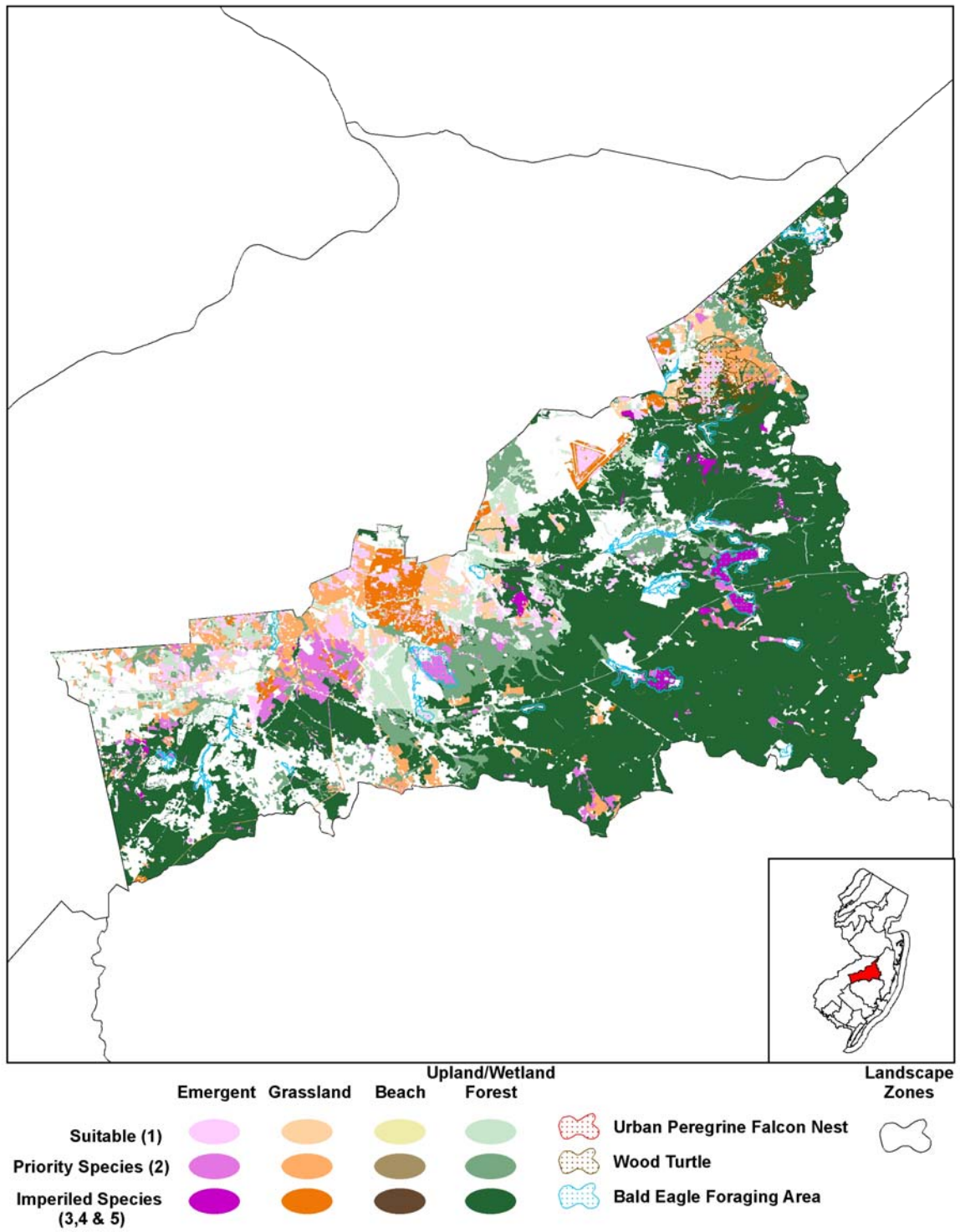
The dominant forest type of the Northern Pinelands Conservation Zone is coniferous pine-forest, with mixed pine-oak and deciduous forest somewhat less common (Figure 26). Deciduous forested wetlands are roughly twice as common as the Atlantic white cedar or coniferous forested wetlands. Emergent wetlands are abundant along this zone's eastern edge, as forests begin to transition into coastal marshes. Within the Pinelands landscape region, the Northern Pinelands contain the highest percentage of developed land, with 24% of the total area of this zone classified as "urban" according to NJDEP's 95/97 Land-use, Land-cover (LULC) data. Conservation areas of opportunity include Collier's Mills WMA, Greenwood WMA, Double Trouble State Park and Lakehurst Naval Station. Only 57% percent of this zone is contained within the Pinelands National Reserve.

b. Wildlife of Greatest Conservation Need

Within the Pinelands region, this zone harbors the highest number of listed species. Two federal threatened, nine state endangered, and ten state threatened species, 73 nongame species of conservation concern, and seven regional priority game species occur in the Northern Pinelands. The bald eagle and bog turtle are the federal threatened wildlife. The red-shouldered hawk, upland sandpiper, vesper sparrow, corn snake, timber rattlesnake, barred owl, black-crowned night-heron, Cooper's hawk, grasshopper sparrow, and Pine Barrens treefrog are some of the state endangered and threatened species. Wildlife species of conservation concern include forest passerines, grassland birds, raptors, scrub-shrub/open field birds, reptiles, and amphibians. In addition, summer populations of forest-dwelling bat species are suspected to occur in the Northern Pinelands.

Agricultural lands are limited in this zone, but grasslands on the Lakehurst Naval Station provide some of the best grassland habitats found anywhere in the state and contain New Jersey's largest known breeding population of upland sandpipers. The field sparrow, grasshopper sparrow, savannah sparrow, vesper sparrow, and northern pine snake also use this site. The diverse habitats of the Northern Pinelands provide cover and food for forest passerines, raptors, scrub-shrub/open field birds, and bald eagle, coastal plain milk snake, corn snake, eastern box turtle, eastern kingsnake, northern pine snake, spotted turtle, timber rattlesnake, carpenter frog, Fowler's toad, marbled salamander, and Pine Barrens treefrog populations. Tables P30 – P36 identify the species of greatest conservation need within this zone.

1 **Figure 26.** Critical landscape habitats within the Northern Pinelands conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Northern Pinelands

Table P30. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat				X**
Birds				
Bald eagle		X	X	X
Reptiles				
Bog turtle		X		

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

** Potential presence.

X: Species occurs within the identified habitat.

Table P31. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				X
Birds				
Black skimmer		X		
Least tern		X		
Red-shouldered hawk				X
Upland sandpiper			X	
Vesper sparrow			X	
Reptiles				
Corn snake				X
Timber rattlesnake				X
Amphibians				
Cope's gray treefrog		X		X

X: Species occurs within the identified habitat.

Table P32. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night heron		X		
Cooper's hawk				X
Grasshopper sparrow			X	
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Northern pine snake			X	X
Wood turtle			X	X
Amphibians				
Pine Barrens Treefrog		X		X

X: Species occurs within the identified habitat.

Table P33. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern red bat				X*
Eastern small-footed myotis				
Hoary bat				X*
Marsh rice rat		X		
Silver-haired bat				X*
Southern bog lemming				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Acadian flycatcher				X
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Black-throated green warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Cattle Egret		X		
Cerulean warbler				X
Common Barn owl			X	
Common nighthawk				
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Great blue heron		X		
Great crested flycatcher			X	
Great egret		X		
Green heron		X		
Horned lark			X	
Indigo bunting			X	
Least flycatcher				X
Little blue heron		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Rose-breasted grosbeak				X
Saltmarsh sharp-tailed sparrow		X		
Scarlet tanager				X
Seaside sparrow		X		
Snowy egret		X		
Spotted sandpiper		X		
Tricolored heron		X		
Whip-poor-will				X
Wood thrush				X
Worm-eating warbler				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Coastal plain milk snake				X
Eastern box turtle			X	X
Eastern kingsnake				X
Northern diamondback terrapin		X		
Spotted turtle			X	X
Amphibians				
Carpenter frog				X
Fowler's toad		X	X	X
Marbled salamander				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Amphibians (continued)				
Northern Spring Salamander				X
Insects				
A noctuid moth <i>Apharetra dentate</i>				X
A spanworm <i>Itame sp 1</i>				X
Buchholz's gray <i>Hypomecis buchholzaria</i>				X
Carter's noctuid moth <i>Spartiniphaga carterae</i>			X	
Daecke's pyralid moth <i>Crambus daeckellus</i>			X	
Doll's merolonche <i>Merolonche dolli</i>				X
Dotted skipper <i>Hesperia attalus</i>			X	
Hessel's hairstreak <i>Callophrys hesseli</i>				X
Lemmer's pinion moth <i>Lithophane lemmeri</i>				X
Pine Barrens bluet <i>Enallagma recurvatum</i>		X		
Pine Barrens zale <i>Zale sp 1</i>				X
Pink streak <i>Faronta rubripennis</i>				X
Placentia tiger moth <i>Grammia placentia</i>			X	
Scarlet bluet <i>Enallagma pictum</i>		X	X	
Southern ptichodis <i>Ptichodis bistrigata</i>			X	
Two-spotted skipper <i>Euphyes bimacula</i>		X		
Fish				
Banded sunfish**	X			
Black-banded sunfish	X			
Mud sunfish	X			

*Potential presence.

**Species are also recognized as target species of ecoregional concern by the Nature Conservancy – NJ Chapter.

X: Species occurs within the identified habitat.

Table P34. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck		X		
American woodcock			X	X
Canada goose (Atlantic population)	X	X		
Northern bobwhite			X	X
Virginia rail		X		
Wood duck		X		X

X: Species occurs within the identified habitat.

Table P35. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Pirate perch	X
Shield darter	X

X: Species occurs within the identified habitat.

Table P36. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Northern Pinelands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Disturbance and encroachment from the more developed townships of Dover, Howell, Freehold, Lakewood, and Berkeley threaten nesting raptors, corn snakes, northern pine snakes, timber rattlesnakes, and other forest-dwelling species. Major roads such as Route 532, Route 70, and Route 72 transect large forest patches and have a serious impact on many of the less vagile species of rare wildlife such as snakes and amphibians. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, maintain, and/or enhance critical habitats as identified by the Landscape Project and identify and protect critical aquatic habitat of endangered, threatened, and special concern fish species.
- Protect and restore and characteristic Pinelands communities.
- Prevent, stabilize, and reverse declines of interior-forest raptors and passerines, and stabilize populations of timber rattlesnake, corn snake, northern pine snake, freshwater wetland birds, rare reptiles and amphibians and rare dragonflies, damselflies, moths, and butterflies.
- Prevent and stabilize declines of breeding grassland and scrub-shrub/open field wildlife populations.
- Prevent, stabilize, and reverse declines of endangered, threatened, and special concern fish species.
- Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern.
- Prevent illegal collection of rare reptiles and amphibians.

- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need.
- Protect water quality and the availability of wetland habitats, including vernal pools.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public awareness and conservation.

e. Conservation Actions

Priority	Conservation Actions
Protect critical habitats identified by the Landscape Project and critical aquatic habitats	
1°	Identify critical core forests and assess their condition for forest-nesting birds and bald eagles, maintain information in the Landscape Project and Biotics database, and provide this information to the Pinelands Commission. Identify protection strategies (e.g. landowner incentives, acquisition) to maintain large core areas in perpetuity. Identify adjoining habitats that can be managed to enhance the total size of forest habitat.
1°	Develop guidelines for recommended deer densities compatible with enhancing forest health, generally by increasing deer harvest on public lands and adjacent private lands.
1°	Review and improve Landscape Project species habitat models as new land-use/land-cover data and data on species habitat requirements are available. <i>(Protect habitat - Landscape Project)</i>
1°	Act to protect, maintain, enhance, restore, and/or create habitat, as appropriate. Manage forests for large, more contiguous patches, but also maintain the diverse forest community types that currently, and historically, exist(ed) within the Pinelands. <i>(Silviculture - land management; Protect habitat - sprawl)</i>
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. <i>(Protect habitat - Landscape Project, fish)</i>
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. <i>(Protect habitat - fish)</i>
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. <i>(Monitor wildlife - fish)</i>

1

Priority	Conservation Actions (continued)
Protect and restore characteristic Pinelands communities	
1°	Work with the Office of Natural Lands Management and the New Jersey Forest Fire Service to determine the historic, and possible future, role of fire in the creation and management of unique Pinelands communities. Research the different management techniques that might be used to mimic the historic role of fire in shaping this ecosystem and develop a strategy for how fire (through prescribed burning) can be used as a management tool in this region. (<i>Conserve wildlife – rare wildlife</i>)
1°	Determine the historic temporal and spatial patch diversity that once existed in the Pinelands and restore the dynamic nature of this ecosystem by developing management plans for state lands that incorporate the needs of Pinelands plants and animals. (<i>Conserve wildlife – rare wildlife</i>)
1°	Identify rare and unique Pinelands plant communities and increase protection for these areas. (<i>Protect habitat - Landscape Project</i>)
1°	Develop management plans for utility line rights-of-way that favor the establishment and persistence of native, early successional Pinelands communities. (<i>Enhance habitat – private lands</i>)
Prevent, stabilize, and reverse declines of rare forest wildlife	
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans that will help meet and maintain recovery goals, particularly for forest-interior species and bald eagles. (<i>Conserve wildlife – rare wildlife</i>)
1°	Research the intensity and characteristics of threats to wildlife and their habitat, including effects of habitat loss and alteration, impacts of roads, competition by invasive plants and animals, and how water quality degradation and contaminants affect rare species. (<i>Conserve Wildlife - invasives, contaminants, development; Evaluate restoration - roads</i>)
1°	Investigate terrestrial habitat requirements for the northern pine snake, and developed a predictive model to identify pine snake habitat. Such a model should be developed with input from the Pinelands Commission so that it can be a fundamental tool used in their evaluation of development applications. The model will potentially identify critical life stage sites (e.g. nesting areas) that require additional protection from collection, disturbance, and destruction. (<i>Protect habitat - Landscape Project</i>)
1°	Develop and implement proactive habitat management/conservation plans for Pine Barrens treefrogs. Such a plan should include ongoing surveys for this species to identify healthy populations and a scheme to protect habitats to connect populations and maintain viable metapopulations. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Develop management guidelines for private landowners with significant bald eagle, timber rattlesnake, northern pine snake, Pine Barrens treefrog, cavity-nester, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird populations. (<i>Silviculture – land management</i>)
1°	Develop guidelines for recommended deer densities that are compatible with reversing declines of priority forest birds and increase deer harvest on public lands through special hunts and adjacent private lands through municipal deer management plans. (<i>Evaluate restoration - deer</i>)
2°	Research the effects of prescribed burning and habitat fragmentation on northern pine snakes, timber rattlesnakes, and corn snakes.
2°	Identify and implement best management practices for bald eagle, forest-interior passerine and raptor habitat.
Monitor, maintain, and enhance populations of breeding, migratory and wintering waterfowl of conservation concern	
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey.
1°	Determine carrying capacity of pinelands wetlands for breeding wood ducks. (<i>Conserve wildlife – game species</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory and wintering waterfowl. Identify protection strategies to maintain existing waterfowl habitat. (<i>Protect habitat – game species</i>)
Identify and protect summer bat habitat	
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Conserve wildlife – rare wildlife</i>)
2°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat - humans</i>)
2°	Conduct telemetry study during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
Prevent, stabilize, and reverse declines of grassland and scrub/shrub communities	
1°	Develop and implement best management practices (BMPs) for grasslands to improve habitat quality for grassland-dependent species. BMPs will be implemented on large patches such as at the Lakehurst Naval Station and along some utility line rights-of-way. (<i>Conserve wildlife – rare wildlife</i>)

Priority	Conservation Actions (continued)
1°	Maintain existing grassland habitats and work to establish new grasslands or scrub/shrub habitats along some utility line rights-of-way. (<i>Conserve wildlife – rare wildlife</i>)
2°	Manage some rights-of-way for scrub-shrub species with small area requirements. Target land acquisition to add important forest tracts to state ownership. (<i>Conserve wildlife – rare wildlife</i>)
2°	Develop management guidelines for private landowners with significant grassland bird and scrub-shrub/open field bird populations. (<i>Conserve wildlife – rare wildlife</i>)
Prevent, stabilize, and reverse declines of rare fish species	
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat - fish</i>)
Prevent illegal collection of rare amphibians and reptiles	
1°	Locate and protect hibernacula for corn snakes, timber rattlesnakes, and northern pine snakes. (<i>Protect habitat - humans</i>)
1°	Protect critical sites (nesting, basking, gestation, dens) and implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (northern pine snakes) and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
2°	Recruit and educate local law enforcement of endangered species laws and protect native wildlife from illegal collection (including bog and wood turtles, and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road vehicles). (<i>Protect wildlife – humans, recreational vehicles</i>)
2°	Protect corn snake, northern pine snake, timber rattlesnake, and Pine Barren treefrog populations from illegal collection. (<i>Protect wildlife - humans</i>)
Inventory and monitor wildlife	
1°	Conduct surveys and determine the eastern range limit of the Pine Barrens treefrog. (<i>Protect habitat - Landscape Project</i>)
1°	Conduct surveys for dragonflies and damselflies in appropriate habitats throughout the Northern Pinelands. (<i>Enhance habitat - odonata</i>)
1°	Establish long-term monitoring programs for birds, reptiles, and amphibians and determine baseline abundance for these groups. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Survey suitable habitats to determine distribution of wildlife of greatest conservation need and establish baseline information. Repeat surveys for woodland raptors every four years. (<i>Protect habitat - Landscape Project</i>)
1°	Conduct concentrated field sampling for listed or special concern fish species at areas indicated by FishTrack Database queries. (<i>Monitor wildlife - fish</i>)
2°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, scrub-shrub/open field bird, and other critical habitat. (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)

Priority	Conservation Actions (continued)
Protect water quality and maintain adequate buffers	
1°	Protect habitats through innovative public and private partnerships. Promote existing landowner incentives for protecting and managing wildlife habitat and develop landowner cooperative agreements to protect significant bald eagle, scrub-shrub/open field bird, and other critical habitat.
1°	Maintain ecologically relevant buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Protect habitat - humans</i>)
1°	Identify and research water quality parameters for such species as T&E species, northern diamondback terrapin spotted turtle and special concern amphibian populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Conserve wildlife – rare wildlife</i>)
2°	Locate potential vernal pools and integrate certified vernal pools into the DEP regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
2°	Identify threats to vernal pools and devise strategies to protect vernal pool-dependent wildlife. (<i>Conserve wildlife – rare wildlife</i>)
Maintain ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where forest regeneration is possible and to enhance forest health and biodiversity. (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits (<i>Conserve wildlife – deer; Evaluate restoration - deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck.”). (<i>Conserve wildlife – deer</i>)
1°	Through surveys and public participation, identify areas where invasive, non-indigenous plants are either already established or are becoming established. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private landowners to employ physical, chemical, or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife - invasives</i>)

1

Priority	Conservation Actions (continued)
1°	Work with land management agencies to monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the southern pine beetle, orange-striped oakworm, gypsy moth, and oak lace bug. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Evaluate restoration – invasives</i>)
Promote public awareness and conservation	
1°	Identify and implement best management practices to maintain and enhance the Northern Pinelands as a significant habitat for forest-interior species and bald eagles.
2°	Develop and maintain educational materials (e.g. A Field Guide to Dragonflies and Damselflies of New Jersey) and viewing opportunities for the public. (<i>Education - humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education - humans</i>)

2

f. Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect bald eagle, red-headed woodpecker, cavity-nester, forest passerine, freshwater wetland bird, grassland bird, raptor, and scrub-shrub/open field bird nesting sites.
 - Utilize incentive programs that encourage the management of forests, grassland and scrub/shrub communities.
 - Through incentive programs, encourage private landowners surrounding public natural lands to manage land for large forest patches in order to increase effective size and connectivity of forests.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer bat habitat.
 - Encourage farmers to preserve farmland with conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of forests, grassland and scrub/shrub communities.
 - Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions and harmful insect infestations. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
 - Work with landowners to maintain/enhance existing habitats where listed and special concern fish species occur.
 - In the context of landowner incentive programs such as LIP, Forestry Stewardship, etc., work with landowners to develop and implement deer management plans that achieve desired deer densities.

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Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups (Pineland Preservation Alliance (PPA), NJ Audubon Society (NJAS), local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation (NJCF)) and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.
 - Continue volunteer-based summer bat concentration surveys.
 - Collaborate with environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species.
 - Involve Citizen Scientists in management and protection projects, such as protection and posting of bald eagle nesting areas and fencing high road-kill areas for northern diamondback terrapin.
- Collaborate with NJAS to educate public on the effects of feral cats on wildlife species of conservation concern.
- Promote backyard habitat management for migratory raptors and passerines, and for vernal pools where appropriate.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with Pinelands Preservation Alliance (PPA), The Nature Conservancy-NJ Chapter (TNC), NJ Audubon Society (NJAS), NJ Conservation Foundation (NJCF), and environmental, member-based organizations to protect and enhance habitats.
 - Work with environmental, member-based organizations to protect and enhance large tracts of contiguous forest, especially those adjacent to state lands, beneficial to bald eagle, barred owl, cavity-nesters, and raptor nesting and foraging sites.
 - Work with TNC, NJAS and other environmental, member-based organizations to manage and protect bald eagle, red-headed woodpecker, cavity-nester, and raptor nesting and foraging sites.
 - Work with PPA, TNC, NJAS and other environmental, member-based organizations to protect and enhance sites hosting significant populations of rare dragonflies, damselflies, moths, and butterflies on conservation lands. Consult with conservation organizations to develop educational programs.
 - Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants and invasive insects that can affect forest health.

- Protect and enhance critical habitat where listed or special concern wildlife and fish occur.
- Continue participating in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS) - NJ Field Office, US Department of Defense (DOD), and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats and protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Divisions of Fish and Wildlife (DFW) to collaborate with the Pinelands Commission to identify and protect important habitat for wildlife. When appropriate, change the boundaries of Pinelands Management Areas to better manage development around sensitive areas.
 - Identify valuable habitats for preservation and work with the DEP's Green Acres Program to pursue acquisition of these important areas.
 - Foster a relationship between the DFW and private/public landowners to restrict the use of off-road vehicles in critical wildlife habitats.
 - DFW and USFWS to work with New Jersey's Forest Fire Service and the DEP's Office of Natural Lands Management to develop a strategy for introducing fire ecology back into the Pinelands ecosystem through the use of prescribed burns.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bald eagle sites.
 - DFW and DEP's Land Use Regulation Program to work with the Pinelands Commission to protect sensitive areas around timber rattlesnake hibernacula.
 - DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
 - ENSP, conservation organizations, DEP's Land Use Regulation Program, and the Pinelands Commission to work together to protect vernal pools and appropriately classify wetlands for spotted turtle and special concern amphibian populations.
 - Expand efforts to create habitat and implement best management practices for northern pine snakes, cavity-nesters, forest passerines, freshwater wetland birds, raptors, and scrub-shrub birds on state lands and with other natural resource managers, county and municipal utility authorities and planners.
 - Encourage greater buffers for forest passerines along riparian and floodplain areas with the Pinelands Commission.
 - DFW to work with Lakehurst Naval Station to develop a plan to maintain upland sandpiper, vesper sparrow, grasshopper sparrow, and savannah sparrow habitats by impeding succession with controlled burns and scheduled mowing.
 - DFW will integrate results of research on vegetative structure in response to deer densities into deer management strategies within deer management zones.
 - DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.

- DFW to work with USFWS and other state and federal partners to implement the American Woodcock Management Plan as appropriate.
- DFW to work with USDA-NRCS to ensure that deer management goals are integrated into farm conservation plans that include measurable outcomes.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW and DEP's Bureau of Water Monitoring and Standards to work together to recommend classification upgrades for water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with the Land Use Regulation Program to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with the USFWS, National Park Service and Department of Defense to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control invasive plants in critical wildlife habitats.
- NJDFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
- DFW to lead in the development of educational materials for public and private landowners about forest-dependent and grassland-dependent wildlife and their habitats.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Monitor abundance, productivity, distribution, and trends of upland sandpiper, bald eagle, red-headed woodpecker, timber rattlesnake, cavity-nester, colonial waterbird, forest passerine, freshwater wetland birds, grassland bird, raptor, and scrub-shrub/open field bird populations.
- Monitor contaminant levels that may impact bald eagle populations.
- Monitor population trends, breeding success, and habitat of timber rattlesnakes and northern pine snakes.
- Routinely monitor the population trends of special concern reptiles and special concern amphibians.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.

- 1 • Work with volunteers, private landowners and conservation groups to monitor the success of
- 2 eradication/control projects that target invasive non-indigenous plants.
- 3 • Continue to monitor deer densities and deer harvest data.
- 4 • Develop indicator metrics for monitoring forest health and implement at the scale necessary
- 5 to monitor effectiveness of deer management strategies.
- 6
- 7
- 8

Skylands Landscape

Contents of the Chapter on the Skylands Landscape

- A. *Ecological Units in the Skylands Landscape*
- B. *Geology and Climate*
- C. *Habitats and Conservation Priority Areas of the Skylands Landscape*
- D. *Wildlife of Greatest Conservation Need of the Skylands Landscape*
- E. *Threats to Wildlife and Habitats of the Skylands Landscape Region*
- F. *Priority Conservation Zones, Assessments, and Strategies*
 - 1. *Upper Delaware River Valley and Kittatinny Ridge*
 - a. *Habitats*
 - b. *Wildlife of Greatest Conservation Need*
 - c. *Threats to Wildlife and Associated Habitats*
 - d. *Conservation Goals*
 - e. *Conservation Actions*
 - f. *Potential Partnerships to Deliver Conservation*
 - g. *Monitoring Success*
 - 2. *Kittatinny Valley*
 - 3. *Northern Highlands*
 - 4. *Delaware and Musconetcong River Valleys*
 - 5. *Central Highlands*
 - 6. *Urban Highlands*
 - 7. *Southern Highlands*

The Skylands Landscape extends northwest of the Piedmont Plains, from the southern tip of Hunterdon County to the headwaters of the Ramapo River. The Skylands include all or parts of Hunterdon, Somerset, Warren, Morris, Passaic, and Sussex counties. The Delaware and the North and South Branch of the Raritan River are the prominent rivers and watershed regions in the Skylands.

A. Ecological Units in the Skylands Landscape

The Skylands run across the Hudson Valley, Lower New England, and Northern Appalachian Piedmont Sections. The Hudson Valley in the Skylands has two subsections, the Kittatinny-Shawangunk Ridges (or the Kittatinny Ridge in New Jersey) (221Bd) and the Hudson Limestone Valley (or the Kittatinny Valley). The Lower New England Section consists of two subsections in northwestern New Jersey, the Hudson Highlands (221Ae) and the Reading Prong (221Am). The Skylands also include a portion of the Gettysburg Piedmont Lowland (221Da) subsection of the Northern Appalachian Piedmont.

B. Geology and Climate

The Ridge and Valley, Highlands, and Piedmont physiographic provinces make up the foundation of the Skylands Landscape. Within the Ridge and Valley province, the Kittatinny Ridge is a steep ridge that spans across New Jersey into Pennsylvania and New York. It rises to more than 549 meters (1,801 feet) in elevation. The Kittatinny Valley is a very broad valley of shale and limestone that dips to 122 meters (400 feet) above sea level and lies between the Kittatinny Ridge and the northern extent of the Highlands province's gneiss and granite rocks. The Highlands province consists of the Reading Prong and the southern tip of the Hudson Highlands subsections. From southwest to northeast, broad uplands and narrow valleys of the Reading Prong give way to high hills above 427 meters (1,400 feet) with steep-sided valleys and

glacial lakes of the Hudson Highlands. To the southeast of the Highlands, the landscape opens up to the rolling hills and wide river valleys of the Gettysburg Piedmont Lowland subsection. The average temperature in the Skylands is between 8.9°C and 12.2°C (48 and 54 degrees F.) and the growing season varies between 130 and 180 days. The average annual precipitation is between 1,118mm (44 in.) and 1,270 mm (50 in.).

C. Habitats and Conservation Priority Areas of the Skylands Landscape

The Skylands are dominated by contiguous northern mixed-hardwoods forests, including oak, maple, birch, ash, hickory, hemlock, with white pine, pitch pine-scrub oak forests on the mountaintops, and hemlock ravines alongside mountain streams (252,550 hectares or 975 sq. mi. of forests and 42,778 hectares or 165 sq. mi. of forested wetlands). The valleys that lie between the ridges consist of cultivated fields, grasslands and meadows (91,250 hectares or 352 sq. mi.). It is important to note that habitats identified as “grassland” within the Landscape Map and throughout this document include agricultural lands and therefore, are not necessarily suitable habitats for grassland species. Similarly, scrub/shrub habitat is included in the “forest” and “forested wetlands” habitats on the Landscape Maps. Wetlands (14,608 hectares or 56 sq. mi.) include limestone fens, floodplains, spring-fed wetlands, and the largest concentration of glacial lakes in New Jersey. The Skylands’ large areas of public land and contiguous habitat from the Delaware River to the Kittatinny Ridge, Kittatinny Valley, Wawayanda State Park, and the Rockaway River present tremendous conservation opportunities, despite the pressures of expanding development from the New York metropolitan area (Figure 27).

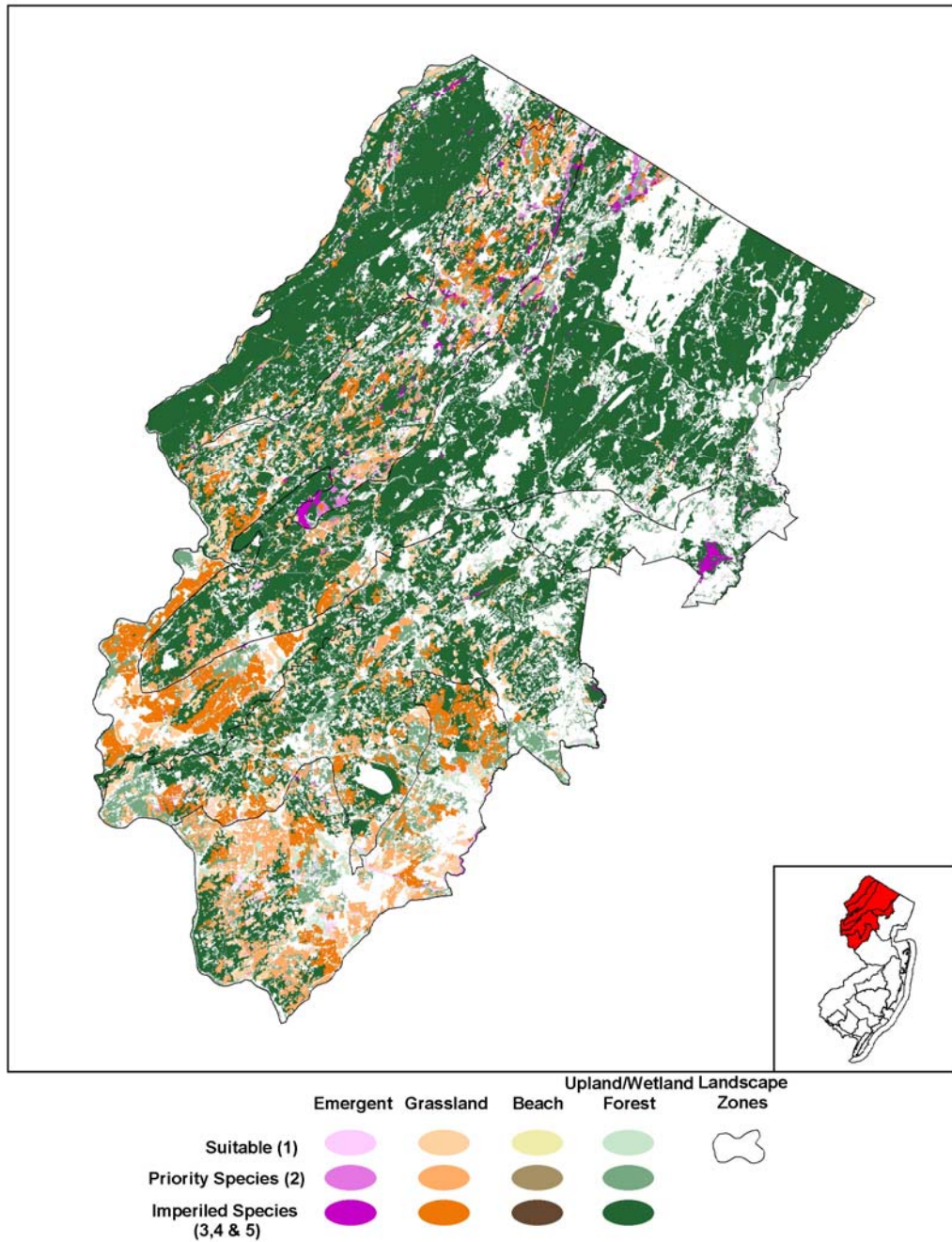
Seven Priority Conservation Zones are identified within the Skylands Region. The zones are delineated by the similarity of habitat types. A description of the habitat types and major land use/land cover types are found in each of the zone sections within this region.

- (1) Upper Delaware River Valley and Kittatinny Ridge
- (2) Kittatinny Valley
- (3) Northern Highlands
- (4) Delaware and Musconetcong River Valleys
- (5) Central Highlands
- (6) Urban Highlands
- (7) Southern Highlands

D. Wildlife of Greatest Conservation Need of the Skylands Landscape

The Skylands Landscape Region supports four federal endangered and threatened, 13 state endangered, 15 state threatened, and 67 special concern wildlife species. The only known hibernacula for the federal endangered Indiana bats occur in the region’s abandoned iron mines. Bog turtles persist on wet meadows and fens in the vast limestone valleys of the Skylands. The region provides riverine and wetland habitat for wood turtles and the only viable population of federal endangered dwarf wedgemussels in New Jersey. The large, contiguous tracts of northern hardwood forest in the Skylands Region are habitat for forest-interior wildlife, including cavity-nesting birds, interior forest nesting passerines, and raptors. Bobcats persist throughout the region in forests and forested wetlands that are not yet highly fragmented by development or agriculture. Rocky outcroppings along mountain ridges provide habitat for timber rattlesnakes. The agricultural landscape of the valleys provides habitat for grassland birds.

1
2 **Figure 27.** Critical landscape habitats within the Skylands Landscape and associated
3 conservation zones as identified through the Landscape Map (v2).



Successful management of the Skylands Landscape is essential to preserving numerous species and suites of species in New Jersey, such as Indiana bat, forest-dwelling bats, bobcat, red-shouldered hawk, northern goshawk, barred owl, forest passerines, grassland birds, scrub-shrub birds, bog turtle, wood turtle, timber rattlesnake, blue-spotted salamander, long-tailed salamander, and dwarf wedgemussel. The majority of the state's remaining native brook trout populations occur in this region's high-water-quality streams. The Skylands Landscape plays a crucial role in the conservation of the following species or species groups: the northern copperhead, eastern box turtle, spotted turtle, northern spring salamander, and vernal pool breeders and special concern mussels. The Skylands Landscape plays an accessory role in the conservation of the Fowler's toad, freshwater wetland birds, and rare dragonflies, damselflies, moths and butterflies.

The Skylands Landscape is characterized by a broad array of habitat types that support a wide variety of wildlife species. Among the more prominent features of the region are the large, contiguous forests of the Kittatinny Ridge and Northern Highlands zones. These provide critical habitat for area-sensitive wildlife such as bobcats, forest-dwelling bats, woodland raptors, neotropical migrant songbirds and timber rattlesnakes. The region's numerous limestone fens, vernal pools, and emergent, riparian and forested wetlands provide critical habitat for freshwater wetland birds, bog turtles, blue-spotted salamanders and a host of other special concern reptiles and amphibians. The clear, unpolluted rivers and streams provide critical habitat for dwarf wedgemussels and other mollusks, wood turtles and long-tailed salamanders. The Kittatinny Valley has a rich history of agriculture and is characterized by open farmlands and smaller forest patches interspersed. Some larger forest patches persist throughout this zone and provide habitat for area-sensitive species. The Delaware and Musconetcong River Valley and Central and Southern Highlands zones contain more highly fragmented habitats that are dominated by agricultural fields and smaller forest patches. Relatively few areas remain in this zone that provide suitable habitat for area-sensitive forest-dwelling species.

Tables S1 – S8 (shown after *Threats to the Wildlife and Habitats of the Skylands Landscape Region*) list the wildlife of greatest conservation need, the suites of wildlife, and the conservation opportunity areas to conserve them in the Skylands. The wildlife are prioritized by federal endangered and threatened, state endangered, state threatened, and special concern status.

E. Threats to the Wildlife and Habitats of the Skylands Landscape Region

Loss, alteration and fragmentation of all habitat types within the Skylands Landscape pose the greatest threats to wildlife in this region. Habitat loss results from development and is occurring at an alarming rate in northern New Jersey. Fragmentation alters the habitat by breaking up large contiguous blocks into smaller patches that are unsuitable for area-sensitive species. New roads fragment habitats and create barriers to animal movements between habitats. Preserving the remaining large, contiguous blocks of habitat, and maintaining connectivity between them, is critical to the long-term viability of area-sensitive wildlife populations in the Skylands.

The discontinuity of emergent and forested wetlands along with the loss of other suitable corridors may eventually lead to the genetic bottlenecking of both bog turtles and spotted turtles. Contamination and alteration of waterways and wetlands, in combination with increased human encroachment into these riparian areas, affect all wetland dependent species and species groups.

Non-point source pollution, unrestricted livestock access, reduction in stream flows, stream cleaning activities, culvert construction and the persistence of dams all have an impact on riparian and riverine species. Human encroachment on wetland habitats often results in an increase in invasive and exotic flora becoming more dominant. These species often decimate native wetland plant communities and can have a deleterious effect on wetland hydrology that results in a loss of habitat value to wetland-dependent wildlife. Illegal collection for the pet trade remains an important problem for many of our rare turtle species.

Invasive, non-indigenous species often cause substantial ecological and economic problems. They frequently have competitive advantages because of the absence of predators, diseases and competitors that they evolved with in other ecosystems or because of more efficient mechanisms of reproduction, dispersal or use of resources. They occur in every broad habitat type that occurs in the state. Invasive, non-indigenous plants threaten species diversity, composition and structure of our fields, forests, wetlands, and aquatic habitats. Invasive, non-indigenous invertebrates such as zebra mussels and Asiatic clams have the potential to adversely impact aquatic habitats and species. Plants such as the Eurasian water-milfoil and vertebrates such as the northern snakehead threaten our aquatic resources and habitats. Emerald ash borer and Asian longhorn beetles have the potential to severely damage our forests and wildlife habitat. Diseases such as West Nile virus have already impacted certain avian species.

New Jersey's burgeoning white-tailed deer population poses a significant threat to forest health and forest regeneration. Deer damage coupled with anthropogenic (caused by man) factors has severely impacted some of New Jersey's remaining public and private natural lands. High numbers of deer find refuge in residential areas or on public and private land where hunting is not allowed. Over-browsing by deer can eliminate native shrub layers and damage breeding habitat for many species, particularly shrub-nesting birds. In addition, over-browsing by deer can create an environment conducive for invasive plants to germinate and crowd out native species and can eliminate rare plant communities.

Increased use of caves and mines for recreational activities poses a major threat to hibernating Indiana and other cave-dwelling bats because it forces them to use crucial fat reserves needed to survive the winter. During hibernation, cave-dwelling bats are highly susceptible to large-scale mortality due to vandalism.

Although New Jersey has an aggressive open space acquisition program, a large portion of critical wildlife habitat in this region remains in private ownership. This accentuates the need to protect, maintain, and enhance critical wildlife habitat on private lands. Without success in this arena we cannot adequately conserve rare species over the long term. With the recent passage of the Highlands Water Protection and Planning Act (Highlands Act), areas that lie within the designated Preservation Area will be afforded additional protection. It is still too early to predict how the Highlands Act will affect municipal land use and land preservation within the Skylands Landscape Region. However, the Highlands Act will result in additional protection for critical wildlife habitat in areas that lie within the Preservation Area. In the short term this will be accomplished through strict limitations on impervious cover; limitations on development on steep slopes, in forested areas, within 300-foot buffers of all water bodies, and in flood areas; and implementation of Category One water quality protections on all Highlands waters. The Division

1 of Fish and Wildlife will work with the Highlands Council to identify critical wildlife habitat
2 through the use of the Landscape Project maps.
3
4

Prioritized List of the Wildlife of Greatest Conservation Need and their Location in the Skylands Landscape

Table S1. Federal Endangered and Threatened Species*

Common Name	Federal Status & Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mammals								
Indiana bat	E	R**	R**	I		R**	R**	
Birds								
Bald eagle	T	I		I				
Reptiles								
Bog turtle	T	I	I	I	I	I		I
Mollusks								
Dwarf wedgemussel	E & RP	I	I					
Insects								
American burying beetle ♦	E		R		R	R		R
Mitchell's satyr ♦	E		R					

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦ Only historic records exist, species believed to be extirpated.

T: Federally threatened species.

E: Federally endangered species.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table S2. State Endangered Species

Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mammals								
Allegheny woodrat		R		R				
Bobcat		I	I	I		I	I	
Birds								
American bittern	RP	I	I	I		I		
Northern goshawk		I		I				
Northern harrier		I	I	I	I	I	I	I
Peregrine falcon		R						
Pied-billed grebe	RP	I	I	I			I	
Red-shouldered hawk		I	I	I		I	I	
Sedge wren	RP		I	I				
Short-eared owl	RP		R		R	R	R	R

State Endangered Species (continued)

Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Birds (continued)								
Upland sandpiper	RP		R		I	I		I
Vesper sparrow		I	I	I	I	I		I
Reptiles								
Timber rattlesnake		I	I	I				
Amphibians								
Blue-spotted salamander			I				I	
Mollusks								
Brook floater	RP	I						
Green floater	RP						R	R
Insects								
Appalachian grizzled skipper		R*	R*		R*		R*	R*
Arogos skipper				I		R		

*Only historic records exist. Species believed to be extirpated.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table S3. State Threatened Species

Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Birds								
Barred owl		I	I	I		I	I	
Black-crowned night-heron	RP	I	I	I			R	
Bobolink	RP	I	I	I	I	I		I
Cooper's hawk	RP	M	M	M	M	M	M	M
Grasshopper sparrow	RP	I	I	I	I	I		I
Long-eared owl		I	I	I		I	I	I
Osprey		R	R	I	I	I		I
Red-headed woodpecker	RP	I	I	I	I	I	I	
Savannah sparrow		I	I	I	I	I		I
Reptiles								
Wood turtle		I	I	I	I	I	I	I
Amphibians								
Long-tailed salamander		I	I	I	I			I
Mollusks								
Eastern lampmussel			I					

State Threatened Species (continued)

Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mollusks (continued)								
Tidewater mucket	RP	R	R	R	R	R	R	R
Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mollusks (continued)								
Triangle floater			I					
Yellow lampmussel	RP	M	M	M	M	M	M	M
Insects								
Silver-bordered fritillary		I	I	I				

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table S4. Nongame Species of Conservation Concern

Common Name	Conservation Status	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mammals								
Eastern small-footed bat	RP			I				
Eastern red bat	RP	R*	R*	R*	R	R*	R*	R*
Hoary bat	RP	R*	R*	R*	R*	R*	R*	R*
Long-tailed (Rock) shrew	RP	R						
Silver-haired bat	RP	R*	R*	R	R*	R*	R*	R*
Southern bog lemming	RP		R	R				
Birds								
Acadian flycatcher	RP	I	I	I	I	I		I
American golden-plover		M	M		M	M	M	
American kestrel	SC	I	I	I	I	I		I
Baltimore oriole	RP	I	I	I	I	I	I	I
Black-and-white warbler	RP	I	I	I	I	I	I	I
Black-billed cuckoo	RP	I	I	I		I		
Blackburnian warbler	RP	M		M				
Black-throated blue warbler	RP	M		M		M		
Black-throated green warbler	SC	I	I	I				
Blue-headed vireo (Solitary vireo)	SC	I		I				
Blue-winged warbler	RP	M	M	M	M	M	M	M

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Birds (continued)								
Broad-winged hawk	SC/ RP	M		M		M		
Brown thrasher	RP	I	I	I	I	I	I	I
Canada warbler	SC/ RP	I	I	I				
Cerulean warbler	SC/ RP	I	I	I	I	I		
Chimney swift	RP	I	I	I	I	I	I	I
Cliff swallow	SC	M	M	M	R	M	R	M
Common barn owl	SC	R	R		R	R	R	R
Common nighthawk	SC	R	R	R	R	R	R	R
Eastern kingbird	RP	I	I	I	I	I	I	I
Eastern meadowlark	SC/ RP	I	I	I	I	I		I
Eastern screech-owl	RP	M	M	M	M	M	M	M
Eastern towhee	RP	I	I	I	I	I	I	I
Eastern wood-pewee	RP	I	I	I	I	I	I	I
Field sparrow	RP	I	I	I	I	I	I	I
Golden-winged warbler	SC/ RP	I	I	I				
Gray catbird	RP	M	M	M	M	M	M	M
Gray-cheeked thrush	SC	M	M	M	M	M	M	M
Great blue heron	SC/ RP	M	M	M	M	M	M	M
Great crested flycatcher	RP	M	M	M	M	M	M	M
Green heron	RP	M	M	M	M	M	M	M
Hooded warbler	RP	M		M		M		M
Horned lark	SC	M	M					
Indigo bunting	RP	I	I	I	I	I	I	I
Kentucky warbler	SC/ RP	I	I		I	I		I
King rail	SC/ RP		I			I	I	
Least bittern	SC/ RP	I	I	I		I	I	
Least flycatcher	SC/ RP	I	I	I	I			
Louisiana waterthrush	RP	I	I	I		I		I
Marsh wren	RP			M		M		
Northern flicker	RP	M	M	M	M	M	M	M
Northern parula	SC	M	M	M		M		M
Pine warbler	RP	M	M	M		M	M	
Prairie warbler	RP	I	I	I	I	I	I	I
Purple finch	RP	I	I	I	I	I		I
Rose-breasted grosbeak	RP	I	I	I	I	I	I	I
Scarlet tanager	RP	M	M	M	M	M	M	M
Sharp-shinned hawk	SC/ RP	M		M	M	M		M
Spotted Sandpiper	SC	M		M	M			
Veery	SC	I	I	I	I	I	I	I
Whip-poor-will	RP	R	R	R				
Willow flycatcher	RP	I	I	I	I	I	I	I

1 Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Birds (continued)								
Winter wren	SC	M		M				
Wood thrush	RP	I	I	I	I	I	I	I
Worm-eating warbler	RP	I	I	I	I	I		I
Yellow-billed sapsucker	RP	M	M	M	M	M	M	M
Yellow-billed cuckoo	RP	I	I	I	I			
Yellow-breasted chat	SC/ RP	I	I	I				
Yellow-throated vireo	RP	M	M	M	M	M	M	M
Yellow-throated warbler	RP	M	M	M	M	M	M	M
Reptiles								
Eastern box turtle	SC	M	M	M	M	M	M	M
Northern copperhead	SC	M	R	M		M	M	M
Eastern hognose snake	RP	M	M	M				
Eastern ribbon snake	RP	M	M	M	M	M	M	M
Spotted turtle	SC	M	M	M		M	M	M
Amphibians								
Carpenter frog	SC			M	M	M		M
Fowler's toad	SC	M	M	M	M	M	M	M
Jefferson salamander	SC	M	M	M		M	M	M
Marbled salamander	SC	M	M	M		M	M	M
Northern spring salamander	SC	M	M	M	M	M		M
Mollusks								
Creeper	SC	I	I					
Insects								
Extra-striped snaketail		X						
Harris's checkerspot	SC			M				
New England bluet		X	X	X				
Northern metalmark	SC	M	M					
A noctuid moth (<i>Cucullia alfarata</i>)			X					
2-spotted skipper				X				
Clubtail dragonfly		X			X			
Pitcher plant borer moth			X					
Schweitzer's buckmoth			X	X				

Nongame Species of Conservation Concern (continued)

Common Name	Conservation Status	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Fish								
American brook lamprey**	RP	I	I	I	I	I	I	I
Bridle shiner	RP	I	I	I		I		I

*Potential presence.

**Species are also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter.

SC: Species of special concern as identified within the state.

RP: Species is of regional priority; currently only mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

Table S5. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Birds								
American black duck	RP	I	I	I	I	I	I	I
Canada goose (Atlantic population)	RP	M	M	M	M	M	M	M
Wood duck	RP	M	M	M	M	M	M	M
American woodcock	RP	I	I	I	I	I	I	I
Northern bobwhite quail	RP				R	R		R
Virginia rail	RP	R	R	R	R	R	R	R
Fish								
Brook trout*	RP	I	I	I	I	I		

*Species is a New Jersey game species, but is also an excellent indicator of water quality.

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

Table S6. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Fish							
Comely shiner					X		X
Cutlips minnow	X	X	X	X	X	X	X
Hickory shad					X		X
Ironcolor shiner			X				
Margined madtom	X	X		X	X	X	X
Northern hogsucker	X						
Shield darter	X			X	X		X
Slimy sculpin	X	X	X	X	X	X	X

X: Species present. Management strategy not yet determined.

Table S7. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Regional Priority	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mammals								
River otter	-	M	M	M	M	M	M	M
Birds								
Ruffed grouse	-	R	R	R	R	R	R	R
Sora rail	-	R	R	R	R	R	R	R
Fish								
Brown trout*	-	I	I	I	I	I		
Rainbow trout*	-	I	I	I	I			

* Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

1 Table S8. Suites of Wildlife and their Location in the Skylands Landscape

Common Name	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Mammals							
Forest-dwelling Large Mammals	X	X	X		X		
Forest-dwelling Bats	X	X	X	X	X	X	X
Birds							
Interior-forest Cavity-nesters	X	X	X	X	X		
Savannah and Forest-edge Habitat Cavity Nesters	X	X	X	X	X	X	X
Chimney Swift	X	X	X	X	X	X	X
Cliff Swallow	X	X	X				X
Colonial Waterbirds	X	X	X	X	X	X	
Common Nighthawk	X	X	X	X	X	X	X
Forest Passerines	X	X	X	X	X	X	X
Freshwater Wetland Birds	X	X	X	X	X	X	
Grassland Birds	X	X	X	X	X		X
Migratory Songbirds and Raptors	X	X	X	X	X	X	X
Peregrine Falcon	X						
Forest Raptors	X	X	X	X	X	X	
Scrub-shrub/Open Field (3-7 yrs) Birds	X	X	X	X	X	X	X
Early Succession (0 -3 years) Open Field Birds	X	X		X	X	X	X
Waterfowl	X	X	X	X	X	X	X
Reptiles							
Forest-dwelling Reptiles	X	X	X	X	X	X	X
Reptile Inhabitants of Wetland, Marsh and Bog	X	X	X	X	X	X	X
Reptiles Associated with water (lakes, ponds, streams)	X	X	X	X	X	X	X
Reptiles of Special Concern	X	X	X	X	X	X	
Amphibians							
Amphibians of Special Concern	X	X	X	X	X	X	
Vernal Pool and Vernal Sinkhole Breeders	X	X	X	X	X	X	X
Limestone Fen Inhabitants		X	X				
Mollusks							
Mollusks of Special Concern	X	X					
Insects							
Lepidoptera of Federal or State Legal Status			X				

1 Suites of Wildlife and their Location in the Skylands Landscape (continued)

Common Name	Upper Delaware River Valley and Kittatinny Ridge	Kittatinny Valley	Northern Highlands	Delaware and Musconetcong River Valleys	Central Highlands	Urban Highlands	Southern Highlands
Insects (continued)							
Lepidoptera of Special Concern		X	X				
Odonata of Special Concern	X	X	X				

2 X: Species occurs within the identified habitat.

F. Priority Conservation Zones, Assessments, and Strategies within the Skylands

1. Upper Delaware River Valley and Kittatinny Ridge

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Associated Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring Success*

a. Habitats

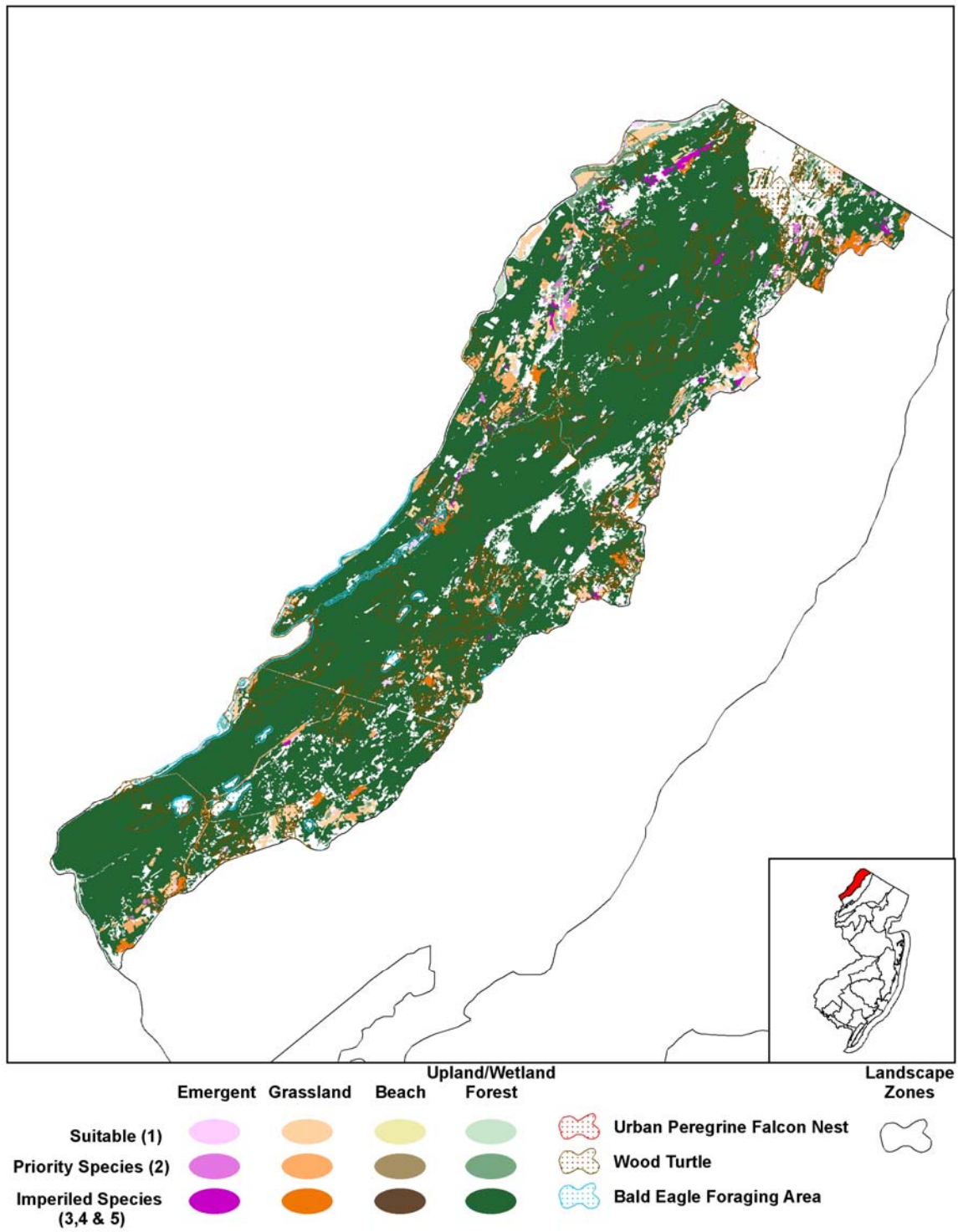
The Upper Delaware River Valley and Kittatinny Ridge encompass the area in New Jersey southwest to northeast along the Delaware River upstream from U.S. Interstate 80 and west from the Kittatinny Valley in the Ridge and Valley physiographic province (Figure 28). Much of this Priority Conservation Zone is preserved as public land. It includes the Big Flat Brook Watershed, the Little Flat Brook Watershed, and the Kittatinny Ridge. Opportunities exist for conservation at the Mashipacong Preserve, Hainesville Wildlife Management Area (WMA), Flat Brook WMA, Roy WMA, Delaware Water Gap National Recreation Area (DWGNRA), Worthington State Forest, Stokes State Forest, and High Point State Park.

Much of the wildlife habitat in this region of the state is a contiguous, maturing mixed hardwood oak-dominated forest. Ridge-tops are covered with pitch pine-scrub oak communities. The Kittatinny Ridge is an important migration corridor for raptors and passerines. Hemlock stands inhabit the ravines created by small streams that flow from the ridge. The forest continues up to the Wild and Scenic Delaware River, with floodplain forest patches of sycamore, silver maple, river birch, and American elm along its banks. The river is an important migration corridor for waterfowl, ospreys, and other birds. Wetland habitats in the Priority Conservation Zone include glacial lakes, beaver-dammed ponds and lakes, artificial farm ponds, wet meadows with thick hummocks, fens, seeps, and vernal pools. Abandoned beaver meadows have become densely covered scrub-shrub habitat, with thickets of alders, willow, and buttonbush. The paucity of pastureland, cropland, old fields, and utility corridors in this zone provide limited habitat for grassland wildlife. A limited amount of early succession habitat exists and is being maintained within the DWGNRA along the Delaware River on the western side of the Kittatinny Ridge.

b. Wildlife of Greatest Conservation Need

The Upper Delaware Valley and Kittatinny Ridge support five federal endangered and threatened, 13 state endangered, 12 state threatened, and 66 special concern and regional priority wildlife species, in addition to five game species of regional priority and five nongame fish species currently without state or regional status. The federal listed species include the endangered dwarf wedgemussel, the threatened bald eagle, and the threatened bog turtle. The state endangered species include the bobcat, American bittern, northern goshawk, red-shouldered hawk, timber rattlesnake, and brook floater. The state threatened species include the barred owl, bobolink, Cooper's hawk, red-headed woodpecker, savannah sparrow, wood turtle, long-tailed salamander, and silver-bordered fritillary. Special concern wildlife include cavity-nesters,

1 **Figure 28.** Critical landscape habitats within the Upper Delaware River Valley and Kittatinny
 2 Ridge conservation zone, as identified through the Landscape Map (v2).



colonial waterbirds, interior forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field birds, reptiles, amphibians, mollusks, and rare damselflies and dragonflies.

The contiguous forest of the ridges in this region is critical habitat for forest-dwelling bats, bobcats, cavity-nesters, migratory raptors and passerines, and forest-nesting passerines. Due to the proximity of known hibernacula, the forests of this zone likely provide summer foraging and roosting habitat for Indiana bats. The forests provide summer foraging habitat for timber rattlesnakes while rocky outcroppings within the forest provide basking and gestating habitat. Eastern box turtles and northern copperheads are also forest-dwelling wildlife inhabiting this zone. The forested wetlands support wood turtles, Fowler's toads, Jefferson salamanders, long-tailed salamanders, marbled salamanders, northern spring salamanders, and silver-bordered fritillaries. The Delaware River's floodplain forest is habitat for bald eagles, colonial waterbirds, and scrub-shrub birds, and provides critical stopover habitat for migrating birds. The diverse wetlands support bog and spotted turtles, colonial waterbirds, freshwater wetland birds, scrub-shrub/open field birds, bald eagles, special concern amphibians, and rare damselflies and dragonflies. The clear mountain streams support some of the state's most robust wood turtle and native trout populations. Tables S9 – S15 identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of Upper Delaware River Valley and Kittatinny Ridge

Table S9. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X**
Birds				
Bald eagle		X		X
Reptiles				
Bog turtle		X		X
Mollusks				
Dwarf wedgemussel	X***			
Insects				
American burying beetle ♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

***Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

♦ Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S10. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Allegheny woodrat***				X
Bobcat		X		X
Birds				
American bittern		X		
Northern goshawk				X
Northern harrier			X	
Pied-billed grebe		X		
Peregrine falcon		X		X
Red-shouldered hawk				X
Vesper sparrow			X	

State Endangered Species (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Reptiles				
Timber Rattlesnake				X
Mollusks				
Brook floater	X**			
Green floater	X**			
Insects				
Appalachian grizzled skipper			X***	

** Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

***Only historic records exist. Species believed to be extirpated within this zone.

X: Species occurs within the identified habitat.

Table S11. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night-heron		X		
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle			X	X
Amphibians				
Long-tailed salamander		X		X
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			
Insects				
Silver-bordered fritillary		X		X

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S12. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Silver-haired bat				X**
Hoary bat				X**
Long-tailed (Rock) shrew				X
Southern bog lemming		X	X	X
Birds				
Acadian flycatcher				X
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blackburnian warbler				X
Black-throated blue warbler				X
Black-throated green warbler				X
Blue-headed vireo (Solitary vireo)				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Birds (continued)				
Canada warbler				X
Cerulean warbler				
Chimney swift		X	X	X
Chuck-will's-widow				X
Cliff swallow		X	X	
Common nighthawk		X	X	X
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Golden-winged warbler				X
Gray catbird			X	X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Hooded warbler				X
Horned lark			X	
Indigo bunting			X	
Kentucky warbler				X
Least bittern		X		
Least flycatcher				X
Louisiana waterthrush				X
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Spotted Sandpiper		X		
Veery				X
Whip-poor-will				X
Willow flycatcher				X
Winter wren				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle		X	X	X
Northern copperhead				X
Eastern hognose snake				X
Eastern ribbon snake		X	X	
Spotted turtle		X		
Amphibians				
Fowler's toad				X
Jefferson salamander				X
Marbled salamander				X
Northern spring salamander		X		X
Mollusks				
Creeper	X***			
Insects				
Northern metalmark		X		X
Extra-striped snaketail	X			X
New England bluet		X		X
Clubtail dragonfly	X			X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Fish				
American brook lamprey*	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

***Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S13. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock		X	X	X
Canada goose (Atlantic population)	X	X		
Wood duck	X	X		X
Virginia rail		X		
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S14. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Cutlips minnow	X
Margined madtom	X
Northern hogsucker	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S15. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X	X	
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Upper Delaware River Valley and Kittatinny Ridge

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The Upper Delaware River Valley and Kittatinny Ridge Zone remains one of the most rural areas in the state, with a large portion in public ownership. The greatest threats to wildlife include habitat fragmentation, degradation, and loss due to unsustainable and unscientific silviculture practices, and development that is occurring on privately owned land. Forest passerines, raptors and bobcats require large, contiguous forest stands. Cavity-nesters require large standing hollow trees for nesting. Disturbance and encroachment from recreational activities on public lands and waters can affect nesting bald eagles and other raptors, and timber rattlesnakes. A limited amount of grassland and scrub/shrub bird habitat occurs primarily along the Delaware River in the northwest portion of this zone that is threatened by changing agricultural practices, development, and reversion of fields to forest. Increased development often results in declining water quality, added pressure on groundwater resources, and the introduction of invasive plants. Inadequate wetland protection through the regulatory process affects bog turtles, amphibians, colonial waterbirds, and freshwater wetland birds. Declining water quality, invasive species, and dam construction impact mussel, nongame fish and wild trout populations. The bioaccumulation of contaminants threatens bald eagles and other raptors. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Protect, identify, maintain, enhance, and restore large contiguous tracts of forest as identified by the Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife as the primary goal for this zone. Included in this group are such species or suites as the bobcat, Indiana and other forest-dwelling bats, the barred owl, red-shouldered hawk, northern goshawk, interior forest passerines, cavity nesting birds, the timber rattlesnake and wood turtle.
- Protect, identify, maintain, enhance, and restore critical wetland habitats as identified by the Landscape Project for freshwater wetland birds, bog turtles, long-tailed salamanders, vernal pool breeders, special concern reptiles and amphibians, rare damselflies and dragonflies and silver-bordered fritillaries.
- Protect, identify, maintain, enhance, and restore critical riverine habitat and water quality to preserve aquatic ecosystems, particularly for dwarf wedgemussels and other special concern mollusks, wood turtles, nongame fish and rare damselflies and dragonflies that rely on high water quality.
- Protect, identify, maintain, enhance, and restore important grassland and scrub/shrub habitats as identified by the Landscape Project for grassland birds and scrub-shrub/open field birds. Due to the relative scarcity of grassland habitat, this is a secondary priority for this zone.
- Inventory, determine distribution, and monitor fish and wildlife of greatest conservation need in the Upper Delaware River Valley and Kittatinny Ridge zone.
- Maintain and, where possible, enhance populations of endangered, threatened, and special concern fish and wildlife in the Upper Delaware River Valley and Kittatinny Ridge zone.

- Prevent, stabilize, and reverse declines of rare freshwater mussels.
- Protect and enhance bald eagle nesting, foraging and roosting habitat.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Identify summer distribution, habitat use, and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Promote public education and awareness and wildlife conservation

e. Conservation Actions

Priority	Conservation Actions
Protect critical forest habitats identified in the Landscape Project	
1°	Identify critical core forests and assess their suitability for interior forest wildlife. Incorporate the information into the Landscape Project and Biotics database. <i>(Protect habitat – Landscape Project)</i>
1°	Maintain and enhance floodplain and ridge-top forests for forest passerines. <i>(Silviculture – Land management; Corridors – Migratory birds; Protect habitat – Landscape Project)</i>
1°	Act to identify, protect, maintain, enhance, restore, and/or create habitat, as appropriate. Work with land managers and private landowners to maintain old growth forest stands with large trees and large contiguous tracts of forest suitable for forest-interior species of raptors and passerines, bobcats and timber rattlesnakes. <i>(Silviculture – Land management; Protect habitat – Landscape Project)</i>
1°	Manage forests to contain a mix of seral (successional) stages to provide habitat for a wide range of forest-dwelling species (e.g. woodland raptors, timber rattlesnakes, cerulean warblers and ruffed grouse and woodcock) within large contiguous tracts while maintaining suitability for area-sensitive species. <ul style="list-style-type: none"> • The primary goal being to maintain or manage for large areas of mature forests with large trees and a canopy closure of > 80% that is suitable for woodland nesting raptors. • Maintain and enhance floodplain forests for forest passerines. Manage forest habitats for woodland raptor suitability. • Selected areas of second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. <i>(Silviculture – Land management; Protect habitat – Landscape Project, migratory birds)</i>
1°	Maintain connectivity of forest habitats within adjacent conservation zones in the Skylands Landscape. Identify important corridors that connect large, contiguous tracts of forest. Target these areas for acquisition to maintain a system of large, connected tracts of forest. <i>(Corridors – sprawl; Protect habitat – Landscape Project)</i>

Priority	Conservation Actions (continued)
1°	Identify critical hibernating, gestating, and basking habitats for timber rattlesnakes along the Kittatinny Ridge. Develop protection strategies to minimize human disturbance and illegal collecting at these sites. Work with public land managers to minimize recreational activities in critical areas. Enlist assistance from state and federal law enforcement personnel to monitor vulnerable areas. (<i>Protect habitat – Landscape Project; Protect wildlife - humans</i>)
2°	Review and improve Landscape Project species habitat models as new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical wetland habitats identified in the Landscape Project	
1°	Identify critical habitats and assess their condition for bog turtles. Develop protection strategies to maintain and enhance populations and habitat. (e.g., innovative public and private partnerships, provide private landowner incentives and develop cooperative agreements to protect and manage habitat. (<i>Protect habitat – Landscape Project; Conserve Wildlife – rare wildlife; Enhance habitat – private lands</i>)
1°	Identify important corridors to maintain a system of large, connected wetland habitats to ensure the long-term viability of these species. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl; Protect habitat – Landscape Project</i>)
1°	Identify critical habitat for silver-bordered fritillaries and manage for the proliferation of host vegetation and to retard succession where appropriate. (<i>Protect habitat – Landscape Project</i>)
1°	Work with public and private landowners to maintain wetland habitat suitability for the target species. This could include such practices as controlled grazing, fencing or biological, mechanical, or chemical control of harmful, invasive vegetation. (<i>Enhance habitat –private lands; Conserve wildlife – rare wildlife</i>)
1°	Identify threats to vernal pools and devise strategies to protect vernal pool dependent species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Locate potential vernal pools and integrate certified vernal pools into the Department of Environmental Protection regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Incorporate freshwater mussel survey results into Riparian Landscape Project and determine critical areas for listed species. (<i>Protect habitat – Landscape Project</i>)
2°	Review and improve Landscape Project species habitat models as new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical riverine habitats for aquatic/ wetland/riparian species.	
1°	Maintain optimal biological buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Enhance habitat –private lands</i>)
1°	Identify, maintain, enhance, and/or protect critical habitats for dwarf wedgemussels, brook floaters, and creepers, and wood turtles, and assess their condition for maintaining populations. (<i>Protect habitat – mussels</i>)

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Priority	Conservation Actions (continued)
1°	Assess specific threats to dwarf wedgemussel, brook floater and creeper, and wood turtle populations, and take the necessary actions to restore, maintain, enhance, and protect habitat, as appropriate. Recommend Category One classification for streams supporting populations. Work with public and private landowners to protect and manage riparian habitat to maintain water quality and reduce siltation. <i>(Protect habitat – mussels; Enhance habitat – private lands)</i>
1°	Identify critical habitats for freshwater nongame fish and wild trout and assess their condition for maintaining populations. <i>(Protect habitat – fish)</i>
1°	Identify and maintain wetlands with snags of dead trees for red-headed woodpeckers and other cavity-nesters. <i>(Protect habitat – development, humans)</i>
1°	Identify and assess large core wetland and riparian habitat and act to protect, enhance, and/or restore habitat through fee purchase, conservation easement, landowner incentives, and/or management plans. <i>(Enhance habitat –private lands)</i>
1°	Identify threats to ground water and determine impacts to vernal pool dependent amphibians, reptiles and invertebrates. <i>(Protect habitat – humans)</i>
1°	Research and evaluate effectiveness of water quality management practices on freshwater wetland birds, bog turtles, wild coldwater fisheries and aquatic invertebrates. <i>(Protect habitat – fish; Enhance habitat – odonata)</i>
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. <i>(Enhance habitat – odonata)</i>
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. <i>(Protect habitat – fish)</i>
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. <i>(Native wildlife – fish)</i>
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. <i>(Monitor wildlife – fish)</i>
1°	Develop and implement habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. <i>(Protect habitat – fish)</i>
1°	Monitor changes in water quality on specific waterways where summer trout habitat may be in jeopardy due to declining water quality. <i>(Protect habitat – fish)</i>
Protect critical grassland and scrub/shrub habitats identified in the Landscape Project	
1°	Identify critical grassland and scrub/shrub habitats and assess their condition for nesting birds. Identify appropriate protection and management strategies (e.g., landowner incentives, farmland preservation, timing restrictions for mowing, cooperative agreements with utility companies for maintenance of rights-of-ways) to maintain and enhance habitat for grassland birds and woodcock. <i>(Protect habitat – sprawl)</i>

Priority	Conservation Actions (continued)
1°	Maintain connectivity when possible by identifying important corridors to maintain a system of connected grassland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. Early succession habitats are limited within this zone and the primary area of opportunity for maintaining and managing these habitats is along the Delaware River within the Delaware Water Gap NRA. <i>(Corridors – sprawl)</i>
1°	Encourage landowners to utilize delayed mowing techniques to allow for grassland birds to successfully fledge young. Convert existing hay and/or row crops to warm season grass fields using landowner incentive programs. Evaluate effectiveness of delayed mowing between warm season grass fields and cool season hay fields. <i>(Enhance habitat –private lands)</i>
Inventory, determine distribution, and monitor fish and wildlife	
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks), northern saw-whet owls and eastern screech-owls. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct surveys for all endangered and threatened species and selected species of special concern in the Delaware River Valley and Kittatinny Ridge Zone at regularly scheduled intervals to track population and habitat trend data (e.g. woodland raptors to be surveyed every four years. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
1°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. <i>(Monitor wildlife – long-term monitoring; Conserve wildlife – rare wildlife)</i>
1°	Conduct concentrated field sampling for listed or special concern fish species in areas indicated by Fish Track database queries. <i>(Protect habitat – fish)</i>
1°	Conduct surveys in suitable, previously un-surveyed areas to determine if listed or special concern freshwater mussel species are present. Repeat surveys every four years to monitor populations. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct the annual Mid-Winter Waterfowl Survey. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. <i>(Conserve wildlife – game species)</i>
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. <i>(Protect habitat – sprawl, development)</i>
Maintain and enhance populations of endangered, threatened, and special concern wildlife and fish	
1°	Determine home range and habitat use for bobcats and wood turtles. Use the information to refine GIS models and integrate into the Landscape Project. <i>(Protect habitat – Landscape Project)</i>

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Priority	Conservation Actions (continued)
1°	Identify and implement best management practices for cavity-nesters, forest passerines, freshwater wetland birds and woodland raptors. (<i>Silviculture – land management</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. (<i>Protect habitat – Landscape Project</i>)
2°	Investigate habitat requirements for woodland raptor populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Identify and research water quality parameters for spotted turtles, Fowler's toads, Jefferson salamanders, marbled salamanders, northern spring salamanders, dwarf wedgemussels, brook floaters, and creepers. (<i>Protect habitat – mussels</i>)
2°	Develop management guidelines for private landowners with significant bald eagle, bog turtle, timber rattlesnake, wood turtle, cavity-nester, freshwater wetland bird, grassland bird, woodland raptor, and scrub-shrub/open field bird populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Research the intensity and characteristics of threats to wildlife and their habitat, including the causes and effects of habitat loss and degradation, edge effects, predation, disease, disturbance, contaminants, water quality, invasive plants, and hybridization. (<i>Conserve wildlife – rare wildlife</i>)
Prevent, stabilize, and reverse declines of rare freshwater mussels	
1°	Protect water quality by maintaining larger buffers around wetlands, riparian and floodplain areas and minimizing destruction. (<i>Protect habitat – sprawl, development</i>)
1°	Seek Category One upgrades for streams with listed freshwater mussels. (<i>Protect habitat – mussels</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – sprawl, development</i>)
Protect and enhance bald eagle habitat	
1°	Identify critical habitats and assess their condition for bald eagle nesting and wintering populations. Develop specific protection strategies to address the threats. (e.g., working with the National Park Service to limit recreational opportunities in areas near eagle nests, closing sections of river shoreline to foot traffic and seasonal trail closures) (<i>Protect habitat – humans, Landscape Project</i>)

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Priority	Conservation Actions (continued)
Protect and enhance important and unique habitats	
1°	Work with federal, state, and local governments to map significant natural communities in the Delaware Water Gap National Recreation Area, Stokes State Forest, High Point State Park, Worthington State Forest, and adjacent wildlife management areas. (<i>Protect habitat – Landscape Project</i>)
1°	Identify, protect, and enhance critical migratory stopover habitats within the Delaware Water Gap National Recreation Area, Stokes State Forest, High Point State Park, Worthington State Forest, and adjacent wildlife management areas. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Work with the federal and state agencies to maintain habitat suitable for area-sensitive species within the Delaware Water Gap National Recreation Area, Stokes State Forest, High Point State Park, Worthington State Forest, and adjacent wildlife management areas. (<i>Protect habitat – Landscape Project, migratory birds, recreational vehicles, humans</i>)
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Evaluate restoration – deer; Conserve wildlife - deer</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. (<i>Evaluate restoration – deer; Conserve wildlife - deer</i>)
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. (<i>Conserve wildlife – invasives</i>)
1°	Identify areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation Prioritize for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to monitor the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
1°	Work with public and private land management agencies to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)

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Priority	Conservation Actions (continued)
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. (<i>Conserve wildlife – cats</i>)
Identify and protect habitat for Indiana bats and other forest-dwelling bat species	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply colored plastic bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines on populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring; Conserve wildlife – development</i>)

Priority	Conservation Actions (continued)
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. (<i>Protect habitat – Landscape Project</i>)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat – humans</i>)
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). (<i>Protect habitat – humans</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Promote public education and awareness and wildlife conservation	
1°	Develop and maintain education materials and viewing opportunities for the public to promote public awareness of wildlife conservation and environmental issues. (<i>Education – humans</i>)
1°	Develop a field guide to NJ's freshwater mussel species to assist in promoting public education and increase awareness of New Jersey's native freshwater mussel fauna. (<i>Education – humans</i>)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. (<i>Education – humans</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans</i>)
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
2°	Educate public about the importance of keeping cats indoors. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of bald eagles, cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field birds.

- Utilize incentive programs that encourage the management of grassland, emergent wetland and scrub/shrub communities and bog turtle habitats and to protect water quality and riparian habitat in areas where rare mussels occur.
- Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of grassland, emergent wetland and scrub/shrub communities and bog turtle habitats.
- Develop and implement landowner incentives for providing, maintaining, and protecting summer and winter bat habitat.
- Develop/maintain cooperative relationships with private landowners with bog turtles on their land.
- Work with landowners to maintain/enhance riparian areas through stream bank restoration and planting native vegetation for dwarf wedgemussels, brook floaters, creepers, wood turtles, nongame fish, and rare damselflies and dragonflies.
- Work with landowners to protect water quality by minimizing use of fertilizers and pesticides for dwarf wedgemussels, brook floaters, creepers, wood turtles, nongame fish, coldwater fish and rare damselflies and dragonflies.
- Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), and NJ Conservation Foundation and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration.
 - Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Collaborate with the National Native Mussel Conservation Committee and other experts to develop best management practices for areas with listed and special concern species.
- Work with American Museum of Natural History to maintain existing NY/NJ freshwater mussel web site.

- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect bald eagle, cavity-nester, and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species
- Consult with conservation organizations to develop educational programs.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS) - NJ Field Office, and US Department of Agriculture (USDA), Natural Heritage Program (NHP) and the Department of Community Affairs (DCA), Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to protect bald eagle, cavity-nester, and raptor nesting and foraging sites.
 - DFW to develop a plan to protect sensitive bald eagle, bog turtle, timber rattlesnake, and wood turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bald eagle, bog turtle, timber rattlesnake, and wood turtle sites.
 - DFW to work with the DEP's Land Use Regulation Program (LURP) to protect sensitive areas around timber rattlesnake hibernacula.
 - DFW and conservation organizations to work with the LURP to protect and appropriately classify wetlands and vernal pools for special concern reptile and amphibian populations.
 - Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of bald eagles, cavity-nesters, forest passerines and raptors, and other forest-dwelling species on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
 - DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program.

- 1 Partner with them to investigate water quality and threats of contaminants/pollution
- 2 and to make recommendations on stream encroachment permit issues for areas with
- 3 listed mussels and rare fish species.
- 4 ○ DFW to work with the DEP's Division of Watershed Management to upgrade stream
- 5 classifications in areas with rare mussels and wild trout populations.
- 6 ○ DFW to develop specific conservation plans for special concern reptiles and
- 7 amphibians on state lands.
- 8 ○ DFW to work with state and county mosquito commissions to prevent the use of
- 9 insecticides and biological controls at known amphibian breeding sites.
- 10 ○ DFW will integrate results of vegetative structure in response to deer densities into
- 11 deer management strategies within deer management zones.
- 12 ○ DFW to work with land management agencies at the state, local, and federal levels to
- 13 implement deer management plans and harvest quotas that achieve desired deer
- 14 densities to maintain ecological integrity of natural communities.
- 15 ○ DFW to work with the USFWS, Department of Defense, and National Park Service to
- 16 develop effective plans to eradicate invasive non-indigenous plants on federal and
- 17 state lands and in aquatic systems that are threatening critical wildlife habitats.
- 18 ○ DFW to work with USDA through NRCS and the WHIP program to control purple
- 19 loosestrife and other invasive plants in critical wildlife habitats.
- 20 ○ DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage
- 21 Program (NHP) to develop mapping of significant vegetative communities to be
- 22 incorporated as a layer within the Landscape Map. Sensitive information would be a
- 23 separate layer for use within the DEP only.
- 24 ○ DFW to interact with other state agencies on operational, regulatory and land-use
- 25 issues to ensure adequate consideration is given to protect coldwater fish resources.
- 26 ○ DFW to determine groundwater recharge areas for bog turtle habitats and long-tailed
- 27 salamander breeding sites with the DEP's Division of Water Quality (DWQ) and the
- 28 NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water
- 29 quality and conduct hydrological monitoring in these areas.
- 30 ○ DFW to work with neighboring state fish and wildlife agencies to radio-track
- 31 dispersing Indiana bats across state boundaries.
- 32 ○ DFW to work with USFWS and other state and federal partners to implement North
- 33 American Waterfowl Management Plan as appropriate.
- 34 ○ DFW to work with USFWS and other state and federal partners to implement
- 35 American Woodcock Management Plan as appropriate.
- 36 ○ DFW and DEP's Water Monitoring and Standards to work together to recommend
- 37 classification upgrades in water bodies where listed or special concern species occur.
- 38 ○ DFW to partner with local, county, and state authorities to establish best management
- 39 practices in areas where listed or special concern fish, freshwater mussels, and
- 40 wildlife species occur.
- 41 ○ DFW to work with the LURP to make recommendations on stream encroachment
- 42 permit issues for areas where listed or special concern species occur.
- 43 ● DFW to lead in the development of educational materials for the public and private
- 44 landowners about wildlife of greatest conservation need and associated habitats.
- 45 ● DFW, conservation organizations, and park commissions to expand public outreach through
- 46 wildlife viewing opportunities.

- DEP to encourage the use of the Landscape Project’s critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP’s Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, and local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project’s critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Determine distribution, occurrence, and monitor bobcats.
- Routinely monitor abundance, productivity, distribution, and trends of bald eagles (annually), bog turtles, timber rattlesnakes, wood turtles, long-tailed salamanders, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years), freshwater wetland birds (2-4 years), and grassland bird, raptor, and scrub-shrub/open field bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird Survey.
- Monitor contaminant levels that may impact bald eagle populations.
- Sponsor “Hawk Watches” for raptor monitoring during the fall migration.
- Monitor extant populations of dwarf wedgemussels, brook floaters and creepers.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- Work with volunteers, private landowners, and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

2. Kittatinny Valley (or Great Valley)

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

The Kittatinny Valley lies in Sussex and Warren counties, between the Kittatinny Ridge and the northern extent of the Highlands Mountain ridges (Figure 29). This broad valley, in the Ridge and Valley physiographic province, contains fertile soils and has a history of agricultural activity. The grassland habitat in the valley includes natural grasslands, croplands, pastures, old farm fields, hedgerows, and brush lots. The headwaters and associated freshwater wetlands of the Paulins Kill, Pequest, and Wallkill rivers are in the Kittatinny Valley. Old farm ponds, limestone fens, wet meadows, and swamps dot the landscape. Although grasslands and open habitats dominate much of the Kittatinny Valley, scattered, large parcels of forest remain interspersed throughout. The upland forest and forested wetland habitat includes stands of deciduous hardwood forest, scrublands and scrub-shrub wetlands, vernal pools, and red maple and hardwood swamps.

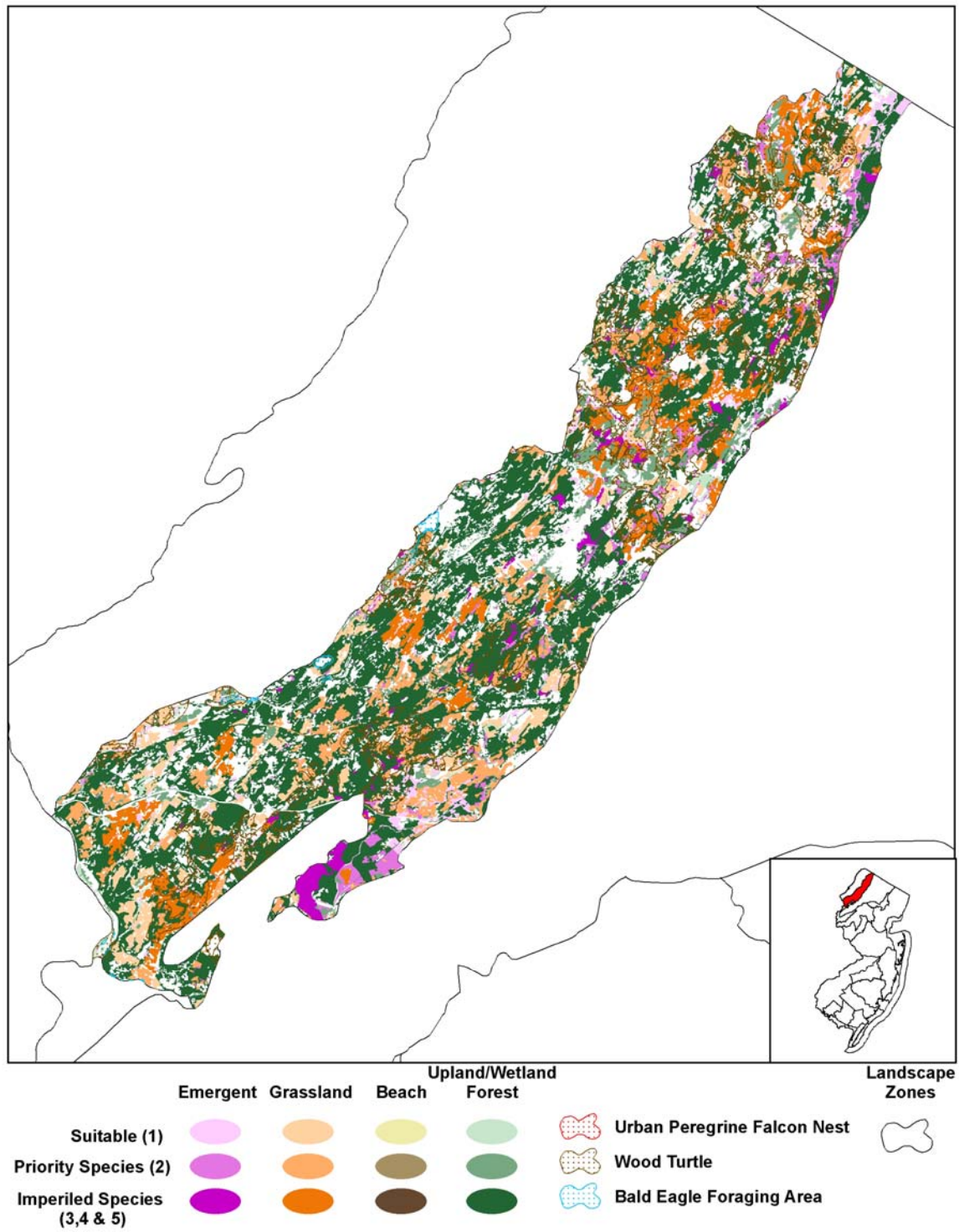
Conservation areas of opportunity in the Kittatinny Valley are Sussex Swamp Preserve, Kittatinny Valley State Park, Paulins Kill River WMA, Wallkill River NWR, White Lake Natural Area and Whittingham WMA.

b. Wildlife of Greatest Conservation Need

Kittatinny Valley habitats support five federal endangered or threatened, 13 state endangered, 16 state threatened, and 77 special concern and regional priority wildlife species, in addition to five game species of regional priority and three nongame fish species currently without state or regional status. The dwarf wedgemussel is federally endangered and the bog turtle is federally threatened. The state endangered species are the American bittern, northern goshawk, northern harrier, red-shouldered hawk, sedge wren, vesper sparrow, and blue-spotted salamander. The state threatened species are the barred owl, black-crowned night heron, bobolink, Cooper's hawk, grasshopper sparrow, long-eared owl, red-headed woodpecker, savannah sparrow, wood turtle, long-tailed salamander, eastern lampmussel, triangle floater, and silver-bordered fritillary. Special concern wildlife in the Kittatinny Valley are colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, scrub-shrub birds, reptiles, amphibians, and mollusks.

Migratory colonial waterbirds, songbirds, raptors, freshwater wetland birds, and waterfowl are funneled through the Kittatinny Valley to take refuge in the forest and wetland habitats. Forests, forested wetlands, and vernal pools also provide important habitat to a diverse group of reptiles and amphibians, including eastern box turtles, spotted turtles, wood turtles, blue-spotted salamanders, Fowler's toads, Jefferson salamanders, long-tailed salamanders, marbled salamanders, and northern spring salamanders. Due to the proximity of known hibernacula, the forests of this zone likely provide summer foraging and roosting habitat for Indiana bats. Bog turtles are found in the fens and wet meadows associated with pastures. The valley's grasslands are critical to grassland birds and to foraging raptors. Dwarf wedgemussels persist in the Pequest

1 **Figure 29.** Critical landscape habitats within the Kittatinny Valley (or Great Valley)
 2 conservation zone, as identified through the Landscape Map (v2).



River, their only known habitat in New Jersey. There are also eastern lampmussels, triangle floaters, and creepers in the valley's rivers and streams. One of the state's only two known Mitchell's satyr wetland habitats is in the Kittatinny Valley. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Kittatinny Valley

Table S16. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat		X		X**
Reptiles				
Bog turtle		X	X	X
Amphibians				
Dwarf wedgemussel	X***			
Insects				
American burying beetle ♦			X	
Mitchell's satyr ♦		X		X

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

***Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

♦ Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S17. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				X
Birds				
American bittern		X		
Northern harrier		X	X	
Pied-billed grebe		X		
Red-shouldered hawk				X
Sedge wren		X		
Short-eared owl		X		
Upland sandpiper			X	
Vesper sparrow			X	
Reptiles				
Timber rattlesnake				X
Amphibians				
Blue-spotted salamander				X
Mollusks				
Green floater	X**			
Insects				
Appalachian grizzled skipper ♦			X	

** Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer.

♦ Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S18. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night heron		X		
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				X
Osprey		X		

State Threatened Species (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle			X	X
Amphibians				
Long-tailed salamander		X		X
Mollusks				
Eastern lampmussel	X**			
Tidewater mucket	X**			
Triangle floater	X**			
Yellow lampmussel	X**			
Insects				
Silver-bordered fritillary				X

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer.

X: Species occurs within the identified habitat.

Table S19. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Hoary bat				X**
Silver-haired bat				X**
Long-tailed (Rock) shrew				X
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American golden-plover				
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Black-throated green warbler				X
Blue-winged warbler				X
Brown thrasher				X
Canada warbler				X
Cerulean warbler				X
Chimney swift			X	
Chuck-will's-widow				X
Cliff swallow		X	X	
Common barn owl		X	X	
Common nighthawk			X	
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl			X	X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Golden-winged warbler				X
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Hooded warbler			X	
Horned lark				
Indigo bunting			X	
Kentucky warbler				
King rail		X		

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Least bittern		X		
Least flycatcher				X
Louisiana waterthrush				X
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Veery				X
Whip-poor-will				X
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X
Eastern hognose snake			X	
Eastern ribbon snake		X	X	
Northern copperhead				X
Spotted turtle		X		
Amphibians				
Fowler's toad				X
Jefferson salamander				X
Marbled salamander				X
Northern spring salamander		X		X
Mollusks				
Creeper	X***			
Insects				
A noctuid moth (<i>Cucullia alfarata</i>)			X	
New England bluet	X	X		
Northern metalmark		X		X
Pitcher plant borer moth		X		
Schweitzer's buckmoth				X
Fish				
American brook lamprey*	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

***Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer.

X: Species occurs within the identified habitat.

Table S20. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock		X		X
Canada goose (Atlantic population)	X	X		
Wood duck	X	X		X
Virginia rail		X		
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S21. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Cutlips minnow	X
Margined madtom	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S22. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Kittatinny Valley

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Habitat loss, degradation, and fragmentation are a concern for wildlife in the Kittatinny Valley. The fragmentation and alteration of grasslands due to development, agricultural practices, and the reversion of fields and scrub-shrub habitats to forest threaten habitat specialist grassland birds and scrub-shrub/open field birds. Deleterious invasive plants and groundwater degradation have altered the fens and wet meadows inhabited by bog turtles. Efforts must be made to protect unique habitats and plant and animal communities such as White Lake Natural Area and Whittingham Natural Area. Beaver, although generally considered beneficial, may be of local concern when their dams flood bog turtle habitat. Road mortality and illegal collection threaten

bog and wood turtles, and over-collection has seriously reduced or possibly extirpated Mitchell's satyr populations. Dam construction and water quality degradation threaten riverine habitats that support mussel, nongame fish and native trout populations. Development continues to fragment the existing large forest parcels inhabited by area-sensitive species of raptors and passerines. New Jersey's burgeoning white-tailed deer population poses a significant threat to forest health and forest regeneration. Deer damage coupled with anthropogenic factors has severely impacted much of New Jersey's remaining public and private natural lands. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Identify, protect, maintain, enhance, and restore critical wetland habitats as identified by Landscape Project for pied-billed grebes, American bitterns, sedge wrens, colonial waterbirds, bog turtles, blue-spotted salamanders, long-tailed salamanders, vernal pool breeders, special concern reptiles and amphibians, Mitchell's satyrs, rare damselflies and dragonflies, and silver-bordered fritillaries. Maintain connectivity between habitats to insure the long-term viability of these species.
- Identify, protect, enhance, and/or restore important riverine habitats for dwarf wedgemussels, special concern mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes, wild trout populations and rare damselflies and dragonflies.
- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical grassland habitat as identified by the Landscape Project for upland sandpipers, northern harriers, vespers, grasshoppers and savannah sparrows, bobolinks, special concern grassland birds, wintering raptors and special concern butterflies and moths.
- Identify, protect, maintain, enhance, and restore large contiguous tracts of forest as identified by the Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as Indiana and other forest-dwelling bats, bobcats, red-shouldered hawks, barred owls, interior forest passerines, cavity nesting birds and timber rattlesnakes. Maintain connectivity of these habitats to ensure the long-term viability of area-sensitive species.
- Identify, protect, maintain, enhance, and restore important scrub/shrub communities.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Kittatinny Valley zone.
- Maintain and, where possible, enhance populations of endangered, threatened, and special concern wildlife and fish in the Kittatinny Valley zone.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Preserve the ecological quality and integrity of vernal pool communities.
- Prevent illegal collection of rare reptiles including bog and wood turtles.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Promote public education and awareness and wildlife conservation

1 e. Conservation Actions

Priority	Conservation Actions
Protect critical wetland habitats identified in the Landscape Project	
1°	Identify critical wetland habitats and assess their suitability for bog turtles and/or other wetland dependent species. Develop and implement strategies to restore, maintain and/or enhance populations and habitat, as appropriate. Actions can include landowner incentives to manage or protect habitat, fencing and grazing, maintaining protective buffers, eliminating invasive, non-native vegetation and controlling water levels in impoundments. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Maintain connectivity between wetland habitats by identifying important corridors to maintain a system of large, connected wetland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl; Protect habitat – Landscape Project</i>)
1°	Identify critical habitat for silver-bordered fritillaries and manage for the proliferation of host vegetation and to retard succession. (<i>Protect habitat – Landscape Project</i>)
1°	Work with public and private landowners to maintain wetland habitat suitability for the target species. Actions could include controlled grazing, fencing or biological, mechanical or chemical control of harmful, invasive vegetation. (<i>Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
1°	Incorporate freshwater mussel survey results into Riparian Landscape Project and determine critical areas for listed species. (<i>Protect habitat – Landscape Project</i>)
2°	Trap and relocate beaver when their dams threaten bog turtle and/or rare plant populations. (<i>Protect habitat – Landscape Project</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical riverine habitats for aquatic/ wetland/riparian species.	
1°	Maintain optimal biological buffers around wetlands, riparian and floodplain areas and minimize destruction. (<i>Enhance habitat – sprawl</i>)
1°	Identify critical habitats for dwarf wedgemussels and other special concern mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes, silver-bordered fritillaries and special concern damselflies and dragonflies and assess their condition for maintaining populations. Work with the Bureau of Freshwater fisheries to identify critical nongame fish and native trout habitat. (<i>Protect habitat – mussels, Landscape Project, fish</i>)
1°	Implement actions to restore, maintain, and/or protect riverine habitat, as appropriate, for target species. Actions can include acquisition, landowner incentives for protection and management, livestock fencing and no-mow riparian buffers. (<i>Protect habitat – sprawl; Enhance habitat – private lands</i>)

1

Priority	Conservation Actions (continued)
1°	Assess specific threats to dwarf wedgemussel, triangle floater and Eastern lampmussels, nongame fishes, native trout, wood turtles and other target species and take the necessary actions to restore, maintain, enhance, and protect habitat, as appropriate. Recommend Category One classification for streams supporting populations. Work with public and private landowners to protect and manage riparian habitat to maintain water quality and reduce siltation. (<i>Protect habitat – mussels, fish, sprawl</i>)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish</i>)
1°	Develop and implement a habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. (<i>Protect habitat – fish</i>)
1°	Monitor changes in water quality on specific waterways where habitat for trout, nongame fishes and aquatic invertebrates may be in jeopardy due to declining water quality. (<i>Protect habitat – fish</i>)
1°	Research and evaluate effectiveness of water quality management practices on freshwater wetland birds, bog turtles, nongame fish, native trout and aquatic invertebrates. (<i>Protect habitat – fish; Enhance habitat – Odonata</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – fish; Enhance habitat – Odonata</i>)
1°	Work with NJDOT to encourage spanning rivers and streams, when feasible, to avoid disturbance of streambeds and riparian habitat and to provide travel corridors for terrestrial wildlife. (<i>Corridors – sprawl</i>)
Protect critical grassland habitats identified in the Landscape Project	
1°	Identify critical habitats for grassland birds and assess their suitability for nesting. Develop protection strategies (e.g., acquisition, easements, and landowner incentives) to establish and maintain large, interconnected public and private grassland tracts. Work with Green Acres and Dept. of Agriculture to identify parcels for acquisition or purchase of development rights. (<i>Protect habitat – sprawl, Landscape Project</i>)
1°	Work with Bureau of Land Management to maintain and enhance grasslands on public lands. Establish mowing schedules, control exotic, invasive vegetation, and establish stands of native warm season grasses. (<i>Conserve wildlife – rare wildlife; Protect habitat – Landscape Project, migratory birds</i>)

1

Priority	Conservation Actions (continued)
1°	Maintain connectivity of grassland and scrub-shrub habitats by identifying important corridors to maintain a system of large, connected grassland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl; Protect habitat – Landscape Project, migratory birds</i>)
1°	Encourage landowners to utilize delayed mowing techniques to allow for grassland birds to successfully fledge young. Convert existing hay and/or row crops to warm season grass fields where appropriate using landowner incentive programs. Evaluate effectiveness of delayed mowing between warm season grass fields and cool season hay fields. (<i>Enhance habitat –private lands</i>)
1°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical forest habitats identified in the Landscape Project	
1°	Work with public and private land managers to maintain large, contiguous tracts of forests suitable for interior forest species. Encourage the maintenance of old-growth stands, uneven-aged stand management and the retention of dead standing and fallen trees. Discourage forestry practices in forested wetlands. Maintain crown closures at $\geq 80\%$ for interior forest species. Maintain and enhance floodplain forests for forest passerines. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. Provide incentives for private landowners to maintain or enhance their forests for wildlife values. (<i>Silviculture – land management; Protect habitat – migratory birds; Conserve wildlife – rare wildlife</i>)
1°	Identify areas within or adjacent to large forest parcels that have the potential to provide habitat for early succession species such as the golden-winged warbler, woodcock and ruffed grouse while protecting the integrity of the forest for area-sensitive species. Manage areas within large forest parcels to provide and maintain early succession habitats. (<i>Silviculture – land management; Conserve wildlife – game species</i>)
2°	Support programs to eliminate or control harmful, invasive, exotic vegetation. (<i>Conserve wildlife – invasives</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect important scrub/shrub communities	
1°	Work with public and private land managers to maintain and enhance scrub/shrub habitats where appropriate. (<i>Conserve wildlife – development; Silviculture – land management</i>)
1°	Develop best management practices for utility rights-of-way to minimize impacts of vegetation management on early-succession wildlife. (<i>Conserve wildlife – development; Silviculture – land management</i>)

Priority	Conservation Actions (continued)
1°	Maintain existing grassland and scrub-shrub habitats and work to establish new grasslands or scrub/shrub habitats along utility-line rights-of-way. (<i>Conserve wildlife – development; Silviculture – land management</i>)
Inventory and monitor endangered, threatened, and special concern wildlife and fish	
1°	Conduct standardized regularly scheduled surveys of rare wildlife to develop baseline data and population trends. Incorporate data into the Landscape Project and Biotics database. (<i>Monitor wildlife – long-term monitoring; Protect habitat – Landscape Project</i>)
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks) and eastern screech-owls. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Determine home range and habitat use for bobcats. Identify important travel corridors. Use information to refine GIS models and integrate into the Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Conduct surveys for woodland raptors every four years to monitor population and habitat trends. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. (<i>Conserve wildlife – game species</i>)
1°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct field sampling for listed or special concern species at areas indicated by Fish Track Database queries. (<i>Monitor wildlife – fish</i>)
1°	Conduct surveys in suitable, previously un-surveyed areas to determine if listed or special concern freshwater mussel species are present. Repeat surveys every four years to monitor populations. (<i>Protect habitat – mussels</i>)
Maintain and enhance populations of endangered, threatened and special concern wildlife and fish	
1°	Manage Mitchell's satyr and silver-bordered fritillary habitats for proliferation of host vegetation and to retard succession where appropriate. (<i>Protect habitat – development; Conserve wildlife – development</i>)
1°	Identify and implement best management practices for cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, scrub/shrub birds and woodland raptors. (<i>Silviculture – land management; Agriculture – land management; Other practices – land management</i>)

1

Priority	Conservation Actions (continued)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. (<i>Protect habitat – Landscape Project</i>)
2°	Identify and research water quality parameters for spotted turtles, Fowler’s toads, Jefferson salamanders, marbled salamanders, northern spring salamanders, dwarf wedgemussels, eastern lampmussels, and triangle floaters. (<i>Protect habitat – mussels; Conserve wildlife – rare wildlife</i>)
2°	Research the intensity and characteristics of threats to wildlife and their habitats, including causes and effects of habitat loss and degradation, disturbance, contaminants, predation, water quality, invasive plants, threats to groundwater-fed pools, and hybridization. (<i>Conserve wildlife – rare wildlife</i>)
Protect and enhance important and unique habitats	
1°	Work with the USFWS, NGO’s and private landowners to protect and manage critical bog turtle sites on public and private lands within the Wallkill National Wildlife Refuge and Wallkill River Watershed. (<i>Protect habitat – Landscape Project, humans; Enhance habitat – private lands</i>)
	Identify, protect, and enhance critical migratory stopover habitats within the Wallkill National Wildlife Refuge and Wallkill River Watershed. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Continue to support the protection of the large wetland complex of the Wallkill National Wildlife Refuge, Wallkill River Watershed, White Lake, and Johnsonburg Preserve. (<i>Protect habitat – Landscape Project, humans, development</i>)
1°	Work with federal, state, and local agencies to map significant natural communities in White Lake and the Johnsonburg Preserve. (<i>Protect habitat – Landscape Project</i>)
1°	Work with local governments and NJ DEP’s Natural Heritage Program (NHP) to protect and enhance the unique natural communities and endangered species at White Lake and the Johnsonburg Preserve. (<i>Protect habitat – humans, development, sprawl; Enhance habitat – private lands</i>)
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Evaluate restoration – deer</i>)

Priority	Conservation Actions (continued)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. (<i>Conserve wildlife – deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck”). (<i>Conserve wildlife – deer</i>)
1°	Work with public and private land management agencies to employ physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives, rare wildlife</i>)
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. (<i>Conserve wildlife – invasives</i>)
1°	Identify areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to survey and monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Collaborate on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
Preserve integrity of vernal pool communities	
1°	Locate potential vernal pools and integrate certified vernal pools into the Department of Environmental Protection regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Work with public and private landowners to protect vernal pools and maintain optimal biological buffers around them. (<i>Protect habitat – sprawl; Enhance habitat – private lands</i>)
1°	Identify threats to ground water and determine impacts to vernal pool dependent amphibians, reptiles, and invertebrates. (<i>Conserve wildlife – rare wildlife</i>)
Prevent illegal collection of rare reptiles	
1°	Notify the NJ Division of Fish and Wildlife’s Bureau of Law Enforcement of critical sites (nesting, basking, gestation, hibernacula) that are vulnerable to illegal collecting, and encourage them to implement stringent enforcement of endangered species laws, including protection of wildlife from illegal collection (including bog and wood turtles), persecution (timber rattlesnake), and human disturbance (off-road-vehicles). Provide information regarding the times of year when illegal collecting is most likely to occur. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
2°	Recruit and educate local law enforcement of endangered species laws. Develop a partnership between them and the NJ Division of Fish and Wildlife's Bureau of Law Enforcement to enforce protection of native wildlife from illegal collection (including bog and wood turtles, corn and pine snakes), persecution (timber rattlesnakes), and human disturbance (off-road-vehicles). (<i>Protect wildlife – humans</i>)
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply colored plastic bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. (<i>Protect habitat – Landscape Project</i>)
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – humans</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Conserve wildlife – rare wildlife</i>)
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. (<i>Protect habitat – humans, Landscape Project</i>)

1

Priority	Conservation Actions (continued)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat – humans</i>)
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). (<i>Protect habitat – humans</i>)
Promote public education and viewing opportunities	
1°	Develop education materials about management practices for the public and for private landowners with significant bog turtle, wood turtle, cavity-nester, freshwater wetland bird, grassland bird, forest passerine, woodland raptor, scrub-shrub/open field bird populations. (<i>Education – humans</i>)
1°	Develop a field guide to NJ's freshwater mussel species to assist in promoting public education and increase awareness of New Jersey's native freshwater mussel fauna. (<i>Education – humans</i>)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. (<i>Education – humans</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
2°	Work to educate the public about the threat posed to native wildlife by free-ranging domestic cats. (<i>Education – humans; Conserve wildlife – cats</i>)
2°	Develop and maintain educational materials and viewing opportunities to promote environmental awareness and wildlife conservation. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans; Protect habitat – fish</i>)

2

3 f. Potential Partnerships to Deliver Conservation

4 Private Landowners

- 5 • Protect and enhance habitat through innovative partnerships with private landowners.
- 6 ○ Implement best management practices that protect nesting and foraging sites of
- 7 cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors,
- 8 and scrub-shrub/open field birds.
- 9 ○ Utilize incentive programs that encourage the management of grassland and
- 10 scrub/shrub communities and bog turtle habitats and to protect water quality and
- 11 riparian habitat in areas where rare mussels occur.
- 12 ○ Encourage farmers to preserve farmland through conservation easements through
- 13 partnerships with Green Acres, the Nature Conservancy, Land Trust, and local

- 1 municipalities for the conservation of grassland and scrub/shrub communities and bog
- 2 turtle habitats.
- 3 ○ Develop and implement landowner incentives for providing, maintaining, and
- 4 protecting summer and winter bat habitat.
- 5 ○ Develop/maintain cooperative relationships with private landowners with bog turtles
- 6 on their land.
- 7 ○ Work with landowners to maintain/enhance riparian areas through stream bank
- 8 restoration and planting native vegetation for dwarf wedgemussels, eastern
- 9 lampmussels and triangle floaters, wood turtles, nongame fish, and rare damselflies
- 10 and dragonflies.
- 11 ○ Work with landowners to protect water quality by minimizing use of fertilizers and
- 12 pesticides for dwarf wedgemussels, eastern lampmussels and triangle floater, wood
- 13 turtles, nongame fish, native trout and rare damselflies and dragonflies.
- 14 ○ Work with landowners to inventory their properties for the presence and severity of
- 15 invasive non-indigenous plant invasions. Work with them to develop effective control
- 16 or eradication measures to protect critical wildlife habitats.
- 17 ○ In the context of landowner incentive programs such as LIP and Forestry
- 18 Stewardship, work with landowners to develop and implement deer management
- 19 plans that achieve desired deer densities.
- 20

21 Public

- 22 • Expand volunteer Citizen Scientist recruitment and activities.
- 23 ○ Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway,
- 24 local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation
- 25 Foundation, and other environmental, member-based organizations to recruit and
- 26 train Citizen Scientists to locate, survey, and monitor wildlife habitats and
- 27 populations in a systematic manner to achieve short- and long-term monitoring goals.
- 28 ○ Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other
- 29 environmental, member-based organizations to recruit and train Citizen Scientists to
- 30 monitor vegetative plots (exclosures) on state lands for evaluation of vegetative
- 31 structure in response to deer densities.
- 32 ○ Recruit North American Butterfly Association volunteers to conduct surveys for moth
- 33 and butterfly species
- 34 ○ Involve Citizen Scientists in conservation projects, such as stream bank restoration.
- 35 ○ Continue volunteer-based summer bat concentration surveys.
- 36

37 Wildlife Professionals

- 38 • Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best
- 39 management practices and conservation plans for scrub-shrub/open field birds.
- 40 • Collaborate with the National Native Mussel Conservation Committee and other experts to
- 41 develop best management practices for areas with listed and special concern species.
- 42 • Work with American Museum of Natural History to maintain existing NY/NJ freshwater
- 43 mussel web site.
- 44 • Consult with animal control officers and extermination companies to implement proper
- 45 removal of bats from houses and educate them on the importance of providing alternative
- 46 roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species.
- Consult with conservation organizations to develop educational programs.
- Encourage the use of the Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's NRCS, USFWS - NJ Field Office, and USDA, and the DCA, Office of Smart Growth to protect, enhance, and create habitats; and protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to protect cavity-nester and raptor nesting and foraging sites.
 - DFW to develop a plan to protect sensitive bog turtle and wood turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.
 - DFW and conservation organizations to work with the DEP's Land Use Regulation Program (LURP) to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
 - DFW to work with the DEP's Division of Watershed Management to upgrade stream classifications in areas with rare mussels, nongame fishes and native and/or wild trout populations.
 - Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, raptors, and other forest-dwelling species, and freshwater wetland birds on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds. Protect important and unique communities of plants and animals such as White Lake and Big Spring Natural Areas.
 - DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels and rare fish species.

- DFW to develop specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
- DFW will integrate results of vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant vegetative communities to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
- DFW to determine groundwater recharge areas for bog turtle habitats, breeding sites for blue-spotted salamander and long-tailed salamander, and vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with USFWS and other state and federal partners to implement American Woodcock Management Plan as appropriate.
- DFW and DEP's Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Periodically monitor abundance, productivity, distribution, and trends of bog turtles, wood turtles, blue-spotted salamanders, long-tailed salamanders, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years), freshwater wetland birds (2-4 years), and grassland bird, raptor, and scrub-shrub/open field bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird Survey.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- Monitor extant sites with dwarf wedgemussels, eastern lampmussels, and triangle floaters.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

3. Northern Highlands

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

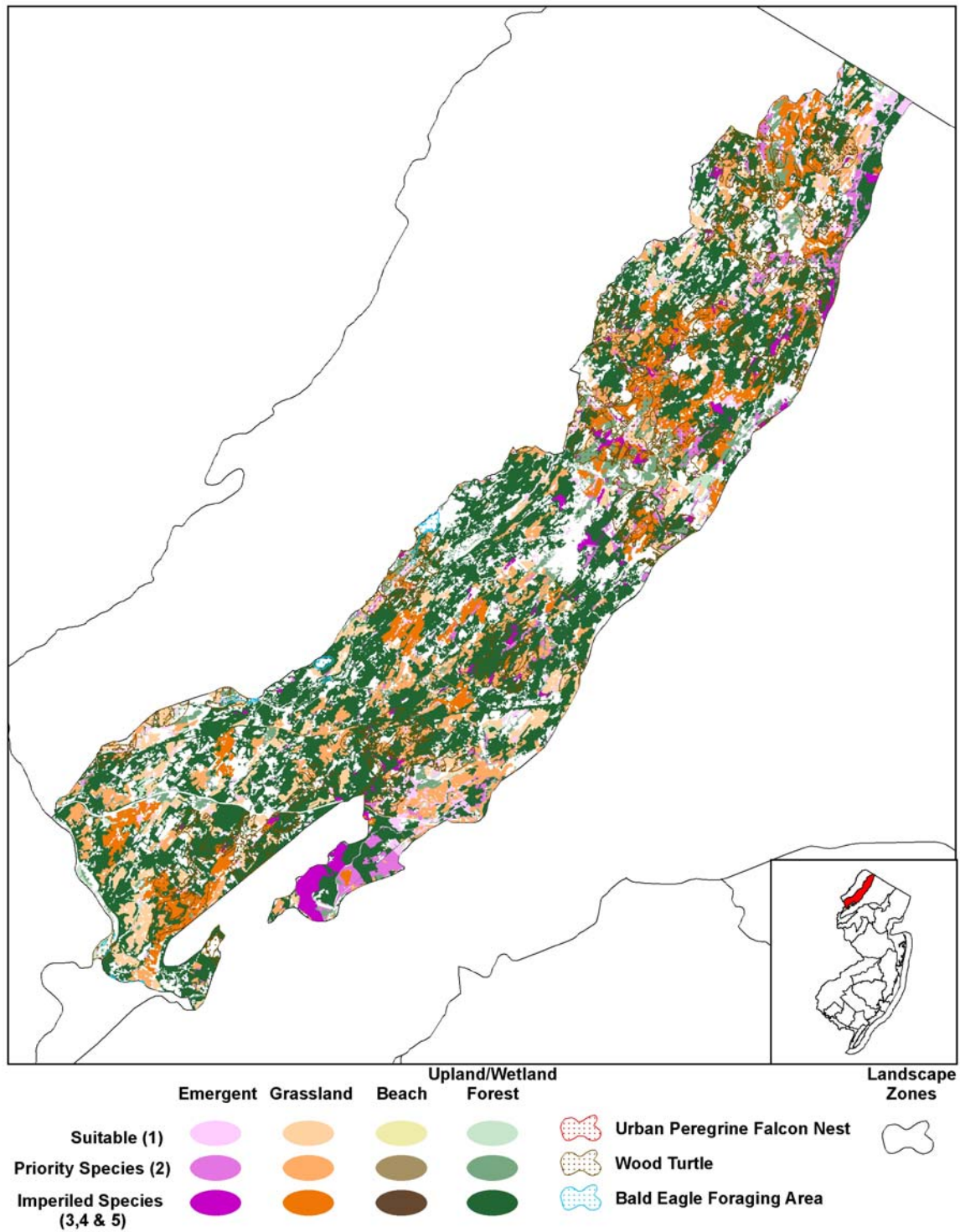
The Northern Highlands Zone is located in portions of Sussex, Passaic, Bergen, Morris, and Warren counties, in the Highlands physiographic province (Figure 30). It starts along the New York state border and follows the higher elevations of the Highland ridges from northeast to southwest. The Northern Highlands include the Wawayanda Plateau, the Wyanokie Highlands, the Ramapo Mountains, Upper Greenwood Lake, Greenwood Lake, and the Wanaque Reservoir at the northern end. Traveling south it includes Green Pond Mountain, Sparta Mountain, Allamuchy Mountain, the Jenny Jumps and Scott's, or Montana Mountain at its southwest terminus.

The Northern Highlands are characterized by expansive mountain ranges and sculpted valleys with contiguous forest cover of mixed oak-hardwood forest and forested wetlands with patches of rocky outcroppings. This area of the Highlands physiographic province includes the headwaters of the Musconetcong, Pequannock, Rockaway, South Branch of the Raritan River, and Wallkill rivers, and Pohatcong Creek. It also has many glacial lakes, beaver-created wetlands, fens, wet meadows, shrub wetlands, and vernal pools. Abandoned iron mines in the region, particularly the Hibernia and Mt. Hope mines, are critical hibernacula for bats in New Jersey. Narrow utility corridors are the primary grassland habitats in the Northern Highlands.

The Wawayanda Plateau includes two conservation opportunity areas, Wawayanda State Park and Abram S. Hewitt State Forest on Bearfort Mountain. The Wyanokie Highlands include Wanaque WMA, Longpond Ironworks State Park, Norvin Green State Forest, and Sterling Forest. The Ramapo Mountains include Ringwood State Park, Ramapo Mountain Forest, and Campgaw Mountain Reservation. Additional areas of conservation opportunity to the south include Hamburg Mountain, Mahlon Dickerson Reservation, Weldon Brook, Sparta Mountain, Rockaway River, Berkshire Valley and Wildcat Ridge WMA's, and Allamuchy Mountain and Jenny Jump state parks.

These areas include large patches of uninterrupted northern hardwood forest, including mixed oak-hardwoods and hemlock ravines. Emergent and forested wetlands are plentiful throughout this zone. There are also numerous vernal pools, glacially formed spring-fed lakes, and beaver ponds.

1 **Figure 30.** Critical landscape habitats within the Kittatinny Valley (or Great Valley)
 2 conservation zone, as identified through the Landscape Map (v2).



b. Wildlife of Greatest Conservation Need

The Northern Highlands support four federal endangered and threatened, 12 state endangered, 14 state threatened, and 81 special concern and regional priority wildlife species, in addition to six game species of regional priority and three nongame fish species currently without state or regional status. The federal endangered species is the Indiana bat and the two federal threatened species are the bog turtle and bald eagle. The state-endangered species are the Allegheny woodrat, bobcat, American bittern, northern goshawk, northern harrier, pied-billed grebe, red-shouldered hawk, sedge wren, vesper sparrow and timber rattlesnake. The state-threatened wildlife includes the barred owl, long-eared owl, Cooper's hawk, red-headed woodpecker, bobolink, grasshopper sparrow, savannah sparrow, wood turtle, long-tailed salamander and silver-bordered fritillary. Special concern wildlife are cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, raptors, scrub-shrub/open field birds, reptiles, and amphibians.

The expansive forest cover of the Northern Highlands is important habitat for raptors, particularly because of the decline of forest habitat throughout other parts of northern New Jersey. Bobcats were successfully reintroduced to the region in the late 1970s as part of a recovery program and persist in un-fragmented forests and forested wetlands throughout the Northern Highlands. Cavity-nesters, forest passerines, nesting great blue herons, wood turtles, eastern box turtles, northern copperheads, Fowler's toads, and marbled salamanders also inhabit the northern hardwood forest and hemlock ravines. Rocky outcroppings provide important seasonal habitat for timber rattlesnakes. Scrub-shrub/open field birds inhabit the shrubby edge of the forests. Wetlands in the Northern Highlands support pied-billed grebes, American bitterns, bog turtles, spotted turtles, and silver-bordered fritillaries. The following tables identify the species of greatest conservation need within this zone.

Wildlife Species and Associated Habitats of the Northern Highlands

Table S23. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat				X
Birds				
Bald eagle				X
Reptiles				
Bog turtle		X		X
Insects				
American burying beetle♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S24. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Allegheny woodrat				X
Bobcat				X
Birds				
American bittern		X		
Northern goshawk				X
Northern harrier		X	X	

State Endangered Species (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Pied-billed grebe		X		
Red-shouldered hawk				X
Sedge wren		X		
Vesper sparrow			X	
Reptiles				
Timber rattlesnake				X
Mollusks				
Green floater	X**			
Insects				
Arogos skipper			X	

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer.

X: Species occurs within the identified habitat.

Table S25. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Black-crowned night-heron		X		
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle			X	X
Amphibians				
Long-tailed salamander		X		
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			
Insects				
Silver-bordered fritillary			X	

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer.

X: Species occurs within the identified habitat.

Table S26. Nongame Species of Conservation Concern

Common Name	Water	Emergent Wetlands	Grasslands	Forest and Forested Wetlands
Mammals				
Eastern small-footed bat				X
Eastern red bat				X**
Hoary bat				X**
Silver-haired bat				X
Long-tailed (Rock) shrew				X
Southern bog lemming			X	X
Birds				
Acadian flycatcher				X
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Blackburnian warbler				X
Black-throated blue warbler				X
Black-throated green warbler				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Emergent Wetlands	Grasslands	Forest and Forested Wetlands
Birds (continued)				
Blue-headed vireo (Solitary vireo)				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Canada warbler				X
Cerulean warbler				X
Chimney swift			X	
Chuck-will's-widow				X
Cliff swallow			X	
Common nighthawk			X	
Eastern kingbird			X	
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Golden-winged warbler				X
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Hooded warbler				X
Indigo bunting			X	
Least bittern		X		
Least flycatcher				X
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Spotted Sandpiper		X		
Veery				X
Whip-poor-will				X
Willow flycatcher				X
Winter wren				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-billed cuckoo				X
Yellow-breasted chat				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle			X	X
Eastern ribbon snake			X	X
Eastern hognose snake			X	X
Northern copperhead				X
Spotted turtle		X		

Nongame Species of Conservation Concern (continued)

Common Name	Water	Emergent Wetlands	Grasslands	Forest and Forested Wetlands
Amphibians				
Carpenter frog		X		
Fowler's toad				X
Jefferson salamander				X
Marbled salamander				X
Northern spring salamander		X		X
Insects				
Two-spotted skipper		X		
Harris's checkerspot		X		
New England bluet	X	X		
Schweitzer's buckmoth				X
Fish				
American brook lamprey*	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table S27. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock		X		
Canada goose (Atlantic population)	X	X		
Wood duck	X	X		X
Virginia rail		X		
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S28. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Cutlips minnow	X
Ironcolor shiner	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S29. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Northern Highlands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Development in northern New Jersey presents the greatest threat to the remaining large tracts of contiguous forest cover that is critical to many of the wildlife species found in the Northern Highlands Zone. Bobcats are vulnerable to encroachment and diseases that are indirectly associated with human presence. Silviculture practices contribute to forest fragmentation, direct disturbance and habitat alteration that can impact forest species. A decline in suitable habitat threatens cavity-nesters, scrub-shrub birds, bog turtles, and wood turtles. Encroachment from recreational activities impacts a variety of species, including timber rattlesnakes and Indiana bats. Freshwater wetland birds, bog turtles, spotted turtles, wood turtles, carpenter frogs, Fowler's toads, and marbled salamanders are vulnerable to water quality degradation from non-point source pollution and habitat loss associated with poorly planned development. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Identify, protect, maintain, enhance, and restore large contiguous tracts of forest as identified by Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as the bobcat, Indiana and other forest-dwelling bats, barred owl, red-shouldered hawk, northern goshawk, interior forest passerines, cavity nesting birds, the timber rattlesnake and wood turtle. Maintaining large contiguous tracts of forest is the primary goal in the Northern Highlands Region.
- Identify, protect, maintain, enhance, and restore critical wetland habitats as identified by the Landscape Project for freshwater wetland birds, bog turtles, long-tailed salamanders, vernal pool breeders, special concern reptiles and amphibians, rare damselflies and dragonflies and silver-bordered fritillaries.
- Identify, protect, maintain, enhance, and restore critical riverine and riparian habitats for wood turtles, rare mollusks, nongame fish and rare damselflies and dragonflies.
- Identify, protect, maintain, enhance, and restore important grassland and scrub/shrub habitats as identified by Landscape Project for grassland birds and scrub-shrub/open field

birds. Maintaining and enhancing scrub/shrub habitats is an important goal in this zone. Grassland habitats within this zone are relatively small and isolated and are therefore, considered to be of secondary importance within the Northern Highlands

- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Northern Skylands Zone.
- Maintain and, where possible, enhance populations of endangered, threatened and special concern wildlife and fish in the Northern Skylands Zone.
- Preserve the ecological quality and integrity of vernal pool communities.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public education and awareness and wildlife conservation.

e. Conservation Strategies

Priority	Conservation Actions
Protect critical forest habitats identified in the Landscape Project	
1°	Work with public and private land managers to maintain large, contiguous tracts of forests suitable for interior forest species. Encourage the maintenance of old-growth stands, uneven-aged stand management and the retention of dead standing and fallen trees. Discourage forestry practices in forested wetlands. Maintain crown closures at $\geq 80\%$ for interior forest species. Maintain and enhance floodplain forests for forest passerines. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. Provide incentives for private landowners to maintain or enhance their forests for wildlife values. <i>(Silviculture – land management; Protect habitat – Landscape Project, migratory birds)</i>
1°	Work with the Bureau of Wildlife Management to identify areas (primarily refuge areas where hunting is prohibited) where deer densities exist at unhealthy levels and develop a strategy to reduce deer numbers and maintain them at acceptable levels that encourage natural forest regeneration. <i>(Conserve wildlife – deer)</i>
1°	Provide incentives for private landowners to maintain or enhance their forests for wildlife values through such programs as LIP, WHIP and Forest Stewardship Program. <i>(Silviculture – land management; Conserve wildlife – rare wildlife)</i>
1°	Maintain connectivity of forest habitats within adjacent conservation zones in the Skylands Landscape. Identify important corridors that connect large, contiguous tracts of forest. Target these areas for acquisition to maintain a system of large, connected tracts of forest. <i>(Corridors – sprawl, migratory birds)</i>
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. <i>(Protect habitat – Landscape Project)</i>

1

Priority	Conservation Actions (continued)
Protect critical wetland habitats identified in the Landscape Project	
1°	Identify critical wetland habitats and assess their suitability for bog turtles and/or other wetland dependent species. Develop and implement strategies to restore, maintain and/or enhance habitat, as appropriate. Actions can include landowner incentives to manage or protect habitat, fencing and grazing, maintaining protective buffers, and eliminating invasive, non-native vegetation. (<i>Protect habitat – Landscape Project; Conserve wildlife – rare wildlife</i>)
1°	Maintain connectivity of wetland habitats by identifying important corridors to maintain a system of large, connected wetland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl, migratory birds</i>)
1°	Identify threats to vernal pools and devise strategies to protect vernal pool dependent species. (<i>Protect habitat – Landscape Project</i>)
Protect critical riverine and riparian habitats identified in the Landscape Project	
1°	Maintain optimal biological buffers around wetlands, riparian, and floodplain areas and minimize destruction. (<i>Protect habitat – sprawl</i>)
1°	Identify critical riparian and riverine habitats and assess their suitability for raptors and passerines, wood turtles, special concern reptiles and amphibians, nongame fishes, native and wild trout and special concern damselflies and dragonflies and assess their condition for maintaining populations. Work with the Bureau of Freshwater fisheries to identify critical nongame fish habitat. (<i>Protect habitat – Landscape Project, fish</i>)
1°	Assess specific threats to nongame fishes, wood turtles and other target species and take the necessary actions to restore, maintain, enhance, and protect habitat, as appropriate. Recommend Category One classification for streams supporting populations of rare species. Work with public and private landowners to protect and manage riparian habitat to maintain water quality and reduce siltation. (<i>Protect habitat – Landscape Project, fish, mussels</i>)
1°	Work with Land Use Regulation, Watershed Management and NJDOT to require large riparian buffers and encourage spanning rivers and streams, when feasible, to avoid disturbance of streambeds and riparian habitat and to provide travel corridors for terrestrial wildlife. (<i>Protect habitat – development</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – development; Agriculture – land management</i>)
1°	Develop and implement habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. (<i>Protect habitat – fish</i>)
1°	Research and evaluate effectiveness of water quality management practices on freshwater wetland birds, wood turtles, nongame fishes, native and wild trout and aquatic invertebrates. (<i>Protect habitat – fish, development</i>)
1°	Protect water quality by seeking possible Category One antidegradation designations in water bodies where listed or special concern species occur. (<i>Protect habitat – fish, mussels</i>)

1

Priority	Conservation Actions (continued)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Monitor wildlife – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife – fish; Protect habitat – Landscape Project</i>)
Protect critical grassland and scrub/shrub habitats identified in the Landscape Project	
1°	Work with utility companies to develop best management practices for rights-of-ways to protect and maintain existing habitat and reduce impacts of vegetation management on wildlife. (<i>Other practices – land management</i>)
1°	Develop best management practices to guide public and private land managers in maintaining and enhancing grassland and other early succession habitats. (<i>Agriculture – land management; Other practices – land management</i>)
1°	Identify areas within or adjacent to large forest parcels that have the potential to provide habitat for early succession species such as the golden-winged warbler, woodcock and ruffed grouse while protecting the integrity of the forest for area-sensitive species. Manage areas within large forest parcels to provide and maintain early succession habitats. (<i>Silviculture – land management; Protect habitat – migratory birds</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply colored plastic bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Conserve wildlife – rare wildlife</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Protect habitat – Landscape Project</i>)
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. (<i>Protect habitat – humans</i>)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat – humans</i>)
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). (<i>Protect habitat – humans</i>)
Inventory and monitor endangered, threatened and special concern wildlife	
1°	Conduct standardized regularly scheduled surveys of rare wildlife to develop baseline data and population trends. Incorporate data into the Landscape Project and Biotics database. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Develop and implement nighttime surveys to inventory nightjars (whip-poor-wills, chuck-will's-widows, common nighthawks), northern saw-whet owls and eastern screech-owls. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)

1

Priority	Conservation Actions (continued)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. (<i>Conserve wildlife – game species</i>)
1°	Determine home range and habitat use for bobcats. Identify important travel corridors. Use information to refine GIS models and integrate into the Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Conduct field sampling for listed or special concern species at areas indicated by Fish Track Database queries. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
Maintain and enhance populations of endangered, threatened and special concern wildlife and fish	
1°	Determine home range and habitat-use for bobcats and wood turtles. Use the information to refine GIS models and integrate into the Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Identify and implement best management practices for cavity-nesters, forest passerines, freshwater wetland birds, and woodland raptors. (<i>Silviculture – land management; Other practices – land management</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. (<i>Protect habitat – Landscape Project</i>)
1°	Identify and research water quality parameters for spotted turtles, Fowler's toads, Jefferson salamanders, marbled salamanders, northern spring salamanders, rare mollusks and nongame fishes. (<i>Protect habitat – fish, mussels</i>)
1°	Investigate habitat requirements for woodland raptor populations. (<i>Protect habitat – Landscape Project</i>)
2°	Develop management guidelines for private landowners with significant bog turtle, timber rattlesnake, wood turtle, cavity-nester, freshwater wetland bird, grassland bird, woodland raptor, and scrub-shrub/open field bird populations. (<i>Agriculture – land management; Silviculture – land management</i>)
2°	Research the intensity and characteristics of threats to wildlife and their habitat, including the causes and effects of habitat loss and degradation, edge effects, predation, disease, disturbance, contaminants, water quality, invasive plants, and hybridization. (<i>Conserve wildlife – rare wildlife</i>)

1

Priority	Conservation Actions (continued)
Preserve the ecological quality and integrity of vernal pool communities	
1°	Locate potential vernal pools and integrate certified vernal pool data into the Department of Environmental Protection regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Identify threats to vernal pools and devise strategies to protect vernal pool dependent species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Work with Land Use Regulation to provide optimal biological buffers to protect certified vernal pools and an adequate amount of upland habitat surrounding the pools. (<i>Protect habitat – development</i>)
Protect and enhance important and unique habitats	
1°	Work with state and local agencies to map significant natural communities in the Mahlon Dickinson Reservation, Rockaway River Wildlife Management Area (WMA), Sparta Mountain WMA, Ringwood State Park, and the US Army Armament Research Development and Engineering Center (Picatinny Arsenal). (<i>Protect habitat – Landscape Project</i>)
1°	Work with local government and private landowners to map significant natural communities in the Newark (Pequannock) Watershed. (<i>Protect habitat – humans, development, sprawl</i>)
1°	Work with Department of Defense to protect critical forest and unique talus habitats on Picatinny Arsenal. (<i>Protect habitat – humans, development, sprawl</i>)
1°	Work with state and local governments to protect critical forests and unique talus habitats in Ringwood State Park and surrounding areas. (<i>Protect habitat – humans, development, sprawl</i>)
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife – deer</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. (<i>Conserve wildlife – deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck.”). (<i>Conserve wildlife – deer</i>)
1°	Identify areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation and prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. (<i>Conserve wildlife – invasives</i>)

1

Priority	Conservation Actions (continued)
1°	Work with public and private landmanagers to collaborate on appropriate physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. (<i>Conserve wildlife – cats</i>)
1°	Work with land management agencies to survey for and monitor the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Research control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)

2

3 **f. Potential Partnerships to Deliver Conservation**

4 Private Landowners

- 5 • Protect and enhance habitat through innovative partnerships with private landowners.
 - 6 ○ Implement best management practices that protect nesting and foraging sites of
 - 7 cavity-nesters, forest passerines, freshwater wetland birds, raptors, and scrub-
 - 8 shrub/open field birds.
 - 9 ○ Utilize incentive programs that encourage the management of grassland and
 - 10 scrub/shrub communities and the conservation of bog turtles, and encourage the
 - 11 protection of water quality and riparian habitat in areas where rare mussels occur.
 - 12 ○ Encourage farmers to preserve farmland through conservation easements through
 - 13 partnerships with Green Acres, the Nature Conservancy, Land Trust, and local
 - 14 municipalities for the conservation of grassland and scrub/shrub communities and bog
 - 15 turtles.
 - 16 ○ Develop and implement landowner incentives for providing, maintaining, and
 - 17 protecting summer and winter bat habitat.
 - 18 ○ Develop/maintain cooperative relationships with private landowners with bog turtles
 - 19 on their land.
 - 20 ○ Work with landowners to inventory their properties for the presence and severity of
 - 21 invasive non-indigenous plant invasions. Work with them to develop effective control
 - 22 or eradication measures to protect critical wildlife habitats.
 - 23 ○ In the context of landowner incentive programs such as LIP and Forestry
 - 24 Stewardship, work with landowners to develop and implement deer management
 - 25 plans that achieve desired deer densities.
 - 26

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for lepidoptera species
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration.
 - Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species.
- Consult with conservation organizations to develop educational programs.
- Encourage the use of Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, USDA's NRCS, USFWS - NJ Field Office, and the DCA, Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to develop a plan to protect sensitive bog turtle, timber rattlesnake, and wood turtle sites from disturbance.

- DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle, timber rattlesnake, and wood turtle sites.
- DFW to work with the Office of State Planning and local and municipal planners to protect sensitive areas around timber rattlesnake hibernacula.
- DFW and conservation organizations to work with the DEP's Land Use Regulation Program (LURP) to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
- Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and freshwater wetland birds on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
- DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels and rare fish species.
- DFW to develop specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
- DFW will integrate results of vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant vegetative communities to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
- DFW to determine groundwater recharge areas for bog turtle habitats and vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.

- DFW to work with USFWS and other state and federal partners to implement American Woodcock Management Plan as appropriate.
- DFW and DEP's Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with the State Planning Commission, the Office of Smart Growth and local governments to protect critical wildlife habitat and unique communities through the designation of Special Resource Areas within the State Development and Redevelopment Plan.
- DFW to work with the newly created Highlands Council to implement the Landscape Project within the Highlands Region. Work with the Council to designate "no build zones" in the preservation area that are identified as critical habitat on the Landscape maps. Help to identify conservation areas in the surrounding planning area based on Landscape maps.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, and local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Determine distribution, occurrence, and monitor bobcats.
- Annually monitor abundance, productivity, distribution, and trends of bog turtles, timber rattlesnakes, wood turtles, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years), freshwater wetland birds (2-4 years), and raptor and scrub-shrub/open field bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird Survey.
- Sponsor "Hawk Watches" for raptor monitoring during the fall migration.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.

4. Delaware and Musconetcong River Valleys

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

The Delaware and Musconetcong River Valleys Zone lies in southern Warren, extreme northern Hunterdon and a very small portion of western Morris counties (Figure 31). Broad river valleys with very fertile soils characterize this zone. Agriculture is the zone's dominant land use. The grassland habitat in these valleys includes natural grasslands, croplands, pastures, old farm fields, utility rights-of-ways, hedgerows, and scrub/shrub dominated areas. Old farm ponds, wet meadows, and swamps infrequently dot the landscape. Scattered, highly fragmented forest parcels remain interspersed throughout. The upland forest and forested wetland habitat includes stands of deciduous hardwood forest, conifer plantations, scrub/shrub uplands and wetlands, vernal pools, and red maple and hardwood swamps. Scattered riparian forests provide important habitat for resident and migratory species.

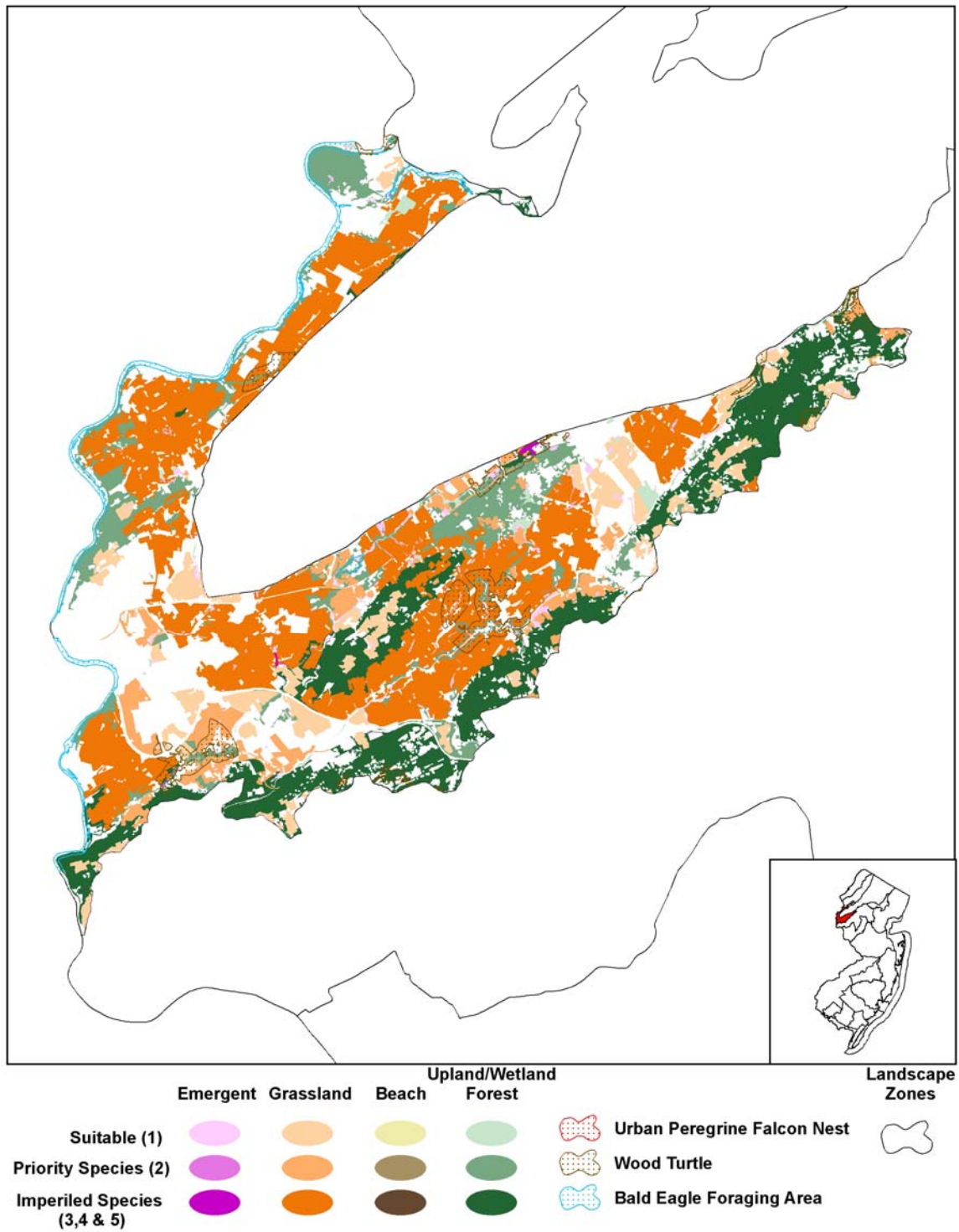
Publicly and privately owned conservation areas of opportunity in the Delaware and Musconetcong River Valleys Zone are scarce. One important area of opportunity includes the Alpha Grasslands in Pohatcong Township.

b. Wildlife of Greatest Conservation Need

The Delaware and Musconetcong River Valley habitats support two federal threatened, five state endangered, 10 state threatened, and 50 special concern and regional priority wildlife species, in addition to seven game species of regional priority and four nongame fish species currently without state or regional status. The federal threatened species include the bog turtle and American burying beetle. The state-endangered species are the northern harrier, upland sandpiper, short-eared owl, vesper sparrow and green floater. State threatened species include the barred owl, bobolink, Cooper's hawk, grasshopper sparrow, red-headed woodpecker, savannah sparrow, wood turtle, long-tailed salamander, eastern lampmussel and triangle floater. Special concern wildlife in the Delaware and Musconetcong river valleys are colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, scrub-shrub birds, reptiles, amphibians, and mollusks.

The Delaware River serves as a migration route for colonial waterbirds, songbirds, raptors, freshwater wetland birds, and waterfowl. These species take refuge in the floodplain forests and wetland habitats adjacent to the Delaware River. Forests, forested wetlands, and vernal pools are important habitats for a diversity of reptiles and amphibians, including eastern box turtles, spotted turtles, wood turtles, Fowler's toads, long-tailed salamanders, marbled salamanders, and northern spring salamanders. Bog turtles are found in the wet meadows associated with pastures. The valley's grasslands are important to grassland birds and winter-foraging raptors. Tables S30 – S36 identify the species of greatest conservation need within this zone.

1 **Figure 31.** Critical landscape habitats within the Delaware and Musconetcong River Valleys
 2 conservation zone, as identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Delaware and Musconetcong River Valleys

Table S30. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat		X		X**
Reptiles				
Bog turtle		X		
Insects				
American burying beetle♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S31. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Northern harrier		X	X	
Short-eared owl			X	
Upland sandpiper			X	
Vesper sparrow			X	
Mollusks				
Green floater	X**			

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S32. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle			X	X
Amphibians				
Long-tailed salamander		X		
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S33. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X
Hoary bat				X**
Silver-haired bat				X**
Long-tailed (Rock) shrew				X
Southern bog lemming			X	X
Birds				
Acadian flycatcher				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Birds (continued)				
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Blue-winged warbler				X
Brown thrasher				X
Cerulean warbler				X
Chimney swift			X	
Cliff swallow		X	X	
Common barn owl			X	
Common nighthawk				X
Eastern kingbird				X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Indigo bunting			X	
Kentucky warbler				X
Least flycatcher				X
Northern flicker				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Spotted Sandpiper		X		
Veery				X
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-billed cuckoo				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle			X	X
Amphibians				
Carpenter frog		X		
Fowler's toad				X
Northern spring salamander		X		
Insects				
Clubtail dragonfly	X			X
Fish				
American brook lamprey*	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table S34. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock		X		X
Canada goose (Atlantic population)	X	X		
Virginia rail		X		
Northern bobwhite quail			X	X
Wood duck	X	X		X
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S35. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Cutlips minnow	X
Margined madtom	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S36. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Delaware and Musconetcong River Valleys

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The extensive grassland habitats of the Delaware and Musconetcong River Valleys are vulnerable to losses, as agricultural lands are highly valued by developers. Considerable habitat loss, fragmentation, and degradation have already impacted grassland wildlife in the region. Riparian habitats are in need of protection throughout the zone. Water quality degradation, human encroachment, illegal collection, disease and harmful invasive exotic plants also threaten wildlife. Over-browsing by deer in areas closed to hunting is negatively impacting habitat for

many species. In addition, these areas become more susceptible to invasion by non-indigenous plants. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical grassland habitat as identified by the Landscape Project for upland sandpipers, northern harriers, vesper, grasshopper and savannah sparrows, bobolinks, special concern grassland birds, wintering raptors and special concern dragonflies. Grasslands are a major feature of this zone.
- Identify, protect, enhance, and restore important riverine habitats for special concern mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes, native and wild trout populations and rare damselflies and dragonflies.
- Identify, protect, maintain, enhance, and restore the remaining large contiguous tracts of forest as identified by the Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as the Cooper’s hawk, red-headed woodpecker, interior forest passerines and cavity nesting birds. Large forest tracts are relatively scarce in this zone and efforts to maintain remaining large tracts is important.
- Identify, protect, maintain, enhance, and restore critical wetland habitats as identified by the Landscape Project for bog turtles, wood turtles and long-tailed salamanders, vernal pool breeders, special concern reptiles amphibians, and rare damselflies and dragonflies.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need.
- Maintain and, where possible, enhance populations of endangered, threatened, and special concern wildlife and fish.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public education and awareness and wildlife conservation

e. Conservation Strategies

Priority	Conservation Actions
Protect critical grassland and scrub/shrub habitats identified in the Landscape Project	
1°	Identify critical grassland and scrub/shrub habitats and assess their condition for nesting birds. Identify appropriate protections strategies (e.g., landowner incentives, farmland preservation, cooperative management agreements, timing restrictions for mowing, cooperative agreements with utility companies for maintenance of rights-of-ways) to maintain and enhance habitat. (<i>Agriculture – land management; Protect habitat – migratory birds</i>)

1

Priority	Conservation Actions (continued)
1°	Maintain connectivity of grassland and scrub-shrub habitats by identifying important corridors to maintain a system of large, connected grassland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl, migratory birds</i>)
1°	Work with private landowners surrounding the Alpha Grasslands to develop cooperative agreements, landowner incentives, etc. to effectively increase the functional size of the grassland habitat in this zone. (<i>Agriculture – land management</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical riverine and riparian habitats	
1°	Protect water quality by maintaining larger buffers around wetlands, riparian and floodplain areas and minimizing destruction. (<i>Corridors – migratory birds; Agriculture – land management; Silviculture – land management</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – mussels, fish; Conserve wildlife – rare wildlife; Agriculture – land management; Silviculture – land management</i>)
1°	Identify critical habitats for special concern mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes and special concern damselflies and dragonflies and assess their condition for maintaining populations. Work with the Bureau of Freshwater Fisheries to identify critical nongame fish and native and wild trout habitat. (<i>Protect habitat – fish; Conserve wildlife – rare wildlife</i>)
1°	Implement actions to restore, maintain and/or protect riverine habitat, as appropriate, for target species. Actions can include acquisition, landowner incentives for protection and management, livestock fencing, no-mow riparian buffers, planting native vegetation in riparian zones to shade streams and control water temperatures. (<i>Agriculture – land management; Silviculture – land management; Corridors – migratory birds</i>)
1°	Assess specific threats to nongame fishes, wood turtles and other target species and take the necessary actions to restore, maintain, enhance, and protect habitat, as appropriate. Recommend Category One classification for streams supporting populations. Work with public and private landowners to protect and manage riparian habitat to maintain water quality and reduce siltation. (<i>Conserve wildlife – rare wildlife; Protect habitat – fish, mussels</i>)
1°	Work with NJDOT to encourage spanning rivers and streams, when feasible, to avoid disturbance of streambeds and riparian habitat and to provide travel corridors for terrestrial wildlife. (<i>Corridors – sprawl; Conserve wildlife – rare wildlife; Protect habitat – fish, mussels</i>)
1°	Continue surveys in the Musconetcong River and associated waterways to determine distribution of triangle floaters and other rare mollusks. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
1°	Develop and implement a habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. (<i>Protect habitat – fish</i>)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Protect habitat – fish, Landscape Project</i>)
Protect critical forest habitats identified in the Landscape Project	
1°	Work with public and private land managers to maintain large, contiguous tracts of forests suitable for interior forest species. Encourage the maintenance of old-growth stands, uneven-aged stand management and the retention of dead standing and fallen trees. Discourage forestry practices in forested wetlands. Maintain crown closures at $\geq 80\%$ for interior forest species. Maintain and enhance floodplain forests for forest passerines. Second-growth forested wetlands of moderate wildlife value should be allowed to mature into an old-growth condition to create future barred owl and red-shouldered hawk habitat. Provide incentives for private landowners to maintain or enhance their forests for wildlife values. (<i>Silviculture – land management; Protect habitat – Landscape Project, migratory birds</i>)
1°	Work with the Bureau of Wildlife Management to identify areas (primarily refuge areas where hunting is prohibited) where deer densities exist at unhealthy levels and develop a strategy to reduce deer numbers and maintain them at acceptable levels that encourage natural forest regeneration. (<i>Conserve wildlife – deer</i>)
1°	Provide incentives for private landowners to maintain or enhance their forests for wildlife values through such programs as LIP, WHIP and Forestry Stewardship Program. (<i>Silviculture – land management; Agriculture – land management</i>)
1°	Maintain connectivity of forest habitats within adjacent conservation zones in the Skylands Landscape. Identify important corridors that connect large, contiguous tracts of forest. Target these areas for acquisition to maintain a system of large, connected tracts of forest. (<i>Corridors – sprawl, migratory birds</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical wetland habitats identified in the Landscape Project	
1°	Identify critical wetland habitats and assess their suitability for bog turtles and/or other wetland dependent species. Develop and implement strategies to restore, maintain and/or enhance habitat, as appropriate. Actions can include landowner incentives to manage or protect habitat, fencing and grazing, maintaining protective buffers, and eliminating invasive, non-native vegetation. (<i>Protect habitat – Landscape Project, migratory birds, sprawl</i>)

1

Priority	Conservation Actions (continued)
1°	Identify important corridors to maintain a system of large, connected wetland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl, migratory birds</i>)
1°	Work with public and private landowners to maintain wetland habitat suitability for the target species. Actions could include controlled grazing, fencing or biological, mechanical or chemical control of harmful, invasive vegetation. (<i>Protect habitat – sprawl; Agriculture – land management; Silviculture – land management</i>)
Identify and protect summer bat habitat	
1°	Conduct state-wide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply-plastic colored bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. (<i>Protect habitat – Landscape Project</i>)
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to populations of bats. (<i>Protect habitat – development</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Protect habitat – Landscape Project</i>)
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. (<i>Protect habitat – humans</i>)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat – humans</i>)
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). (<i>Protect habitat – humans</i>)
Inventory and monitor endangered, threatened and special concern wildlife and fish	
1°	Conduct surveys for all endangered and threatened species and selected species of special concern in the zone at regularly scheduled intervals to track population and habitat trend data. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. (<i>Conserve wildlife – game species</i>)
1°	Conduct field sampling for listed or special concern species at areas indicated by Fish Track Database queries. (<i>Monitor wildlife – long-term monitoring; Protect habitat – fish</i>)
1°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Monitor wildlife – long-term monitoring</i>)
Maintain populations of endangered, threatened and special concern wildlife and fish	
1°	Identify and implement best management practices for cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, scrub/shrub birds and woodland raptors, bog and wood turtles and special concern mollusks. (<i>Silviculture – land management; Agriculture – land management; Conserve wildlife – rare wildlife</i>)
1°	Identify and maintain important winter foraging sites for short-eared owls and northern harriers. Work with private landowners to protect and maintain suitable wintering habitat. Provide incentives through various federal programs. (<i>Silviculture – land management; Agriculture – land management; Protect habitat – migratory birds</i>)

1

Priority	Conservation Actions (continued)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. (<i>Protect habitat – Landscape Project</i>)
2°	Identify and research water quality parameters for spotted turtles, Fowler’s toads, Jefferson salamanders, marbled salamanders, northern spring salamanders and rare mollusks. (<i>Protect habitat – development</i>)
Protect and enhance important and unique habitats	
1°	Work with private landowners adjacent to Alpha grasslands to manage surrounding habitat for grassland species effectively increasing the size of suitable habitat. (<i>Protect habitat – development, sprawl</i>)
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife – deer</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. (<i>Conserve wildlife – deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck”). (<i>Conserve wildlife – deer</i>)
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to identify areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation and prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. (<i>Conserve wildlife – cats, subsidized predators</i>)

1

Priority	Conservation Actions (continued)
1°	Collaborate with public and private landowners to decide on the appropriate physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to survey for and monitor the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Research control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
Promote public education and viewing opportunities	
1°	Develop education materials describing management practices for public land managers and private landowners with significant bog turtle, wood turtle, cavity-nester, grassland bird, forest passerine, woodland raptor, scrub-shrub/open field bird populations. (<i>Education – humans</i>)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
2°	Develop and maintain educational materials and viewing opportunities to promote environmental awareness and wildlife conservation. (<i>Education – humans</i>)
2°	Develop a field guide to NJ's freshwater mussel species to assist in promoting public education and increase awareness of New Jersey's native freshwater mussel fauna. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)

2

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field birds.
 - Utilize incentive programs that encourage the management of grassland and scrub/shrub communities and the conservation of bog turtles, and to protect water quality and riparian habitat in areas where rare mussels occur.
 - Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of grassland and scrub/shrub communities and bog turtles.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer and winter bat habitat.
 - Develop/maintain cooperative relationships with private landowners with bog turtles on their land.
 - Work with landowners for the long-term protection of rare mollusks.
 - Work with landowners to inventory their properties for the presence and severity of non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
 - In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for butterfly species.
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration.
 - Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Collaborate with the National Native Mussel Conservation Committee and other experts to develop best management practices for areas with listed and special concern species.

- Work with American Museum of Natural History to maintain existing NY/NJ freshwater mussel web site.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species
- Consult with conservation organizations to develop educational programs.
- Encourage the use of Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, NRCS, USFWS - NJ Field Office, and USDA, and the DCA, Office of Smart Growth to protect, enhance, and create habitats; and protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to protect cavity-nester and raptor nesting and foraging sites.
 - DFW to develop a plan to protect sensitive bog turtle and wood turtle sites from disturbance.
 - DFW share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.
 - DFW and conservation organizations to work with the DEP's Land Use Regulation Program to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
 - DFW to work with the DEP's Division of Watershed Management to upgrade stream classifications in areas with rare mussels.
 - Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, raptors, and other forest-dwelling species, and freshwater wetland birds on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance, and maintain habitats for grassland and scrub-shrub/open field birds.
 - DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program.
- Partner with them to investigate water quality and threats of contaminants/pollution

- 1 and to make recommendations on stream encroachment permit issues for areas with
- 2 listed mussels and rare fish species.
- 3 ○ DFW to develop specific conservation plans for special concern reptiles and
- 4 amphibians on state lands.
- 5 ○ DFW to work with state and county mosquito commissions to prevent the use of
- 6 insecticides and biological controls at known amphibian breeding sites.
- 7 ○ DFW will integrate results of vegetative structure in response to deer densities into
- 8 deer management strategies within deer management zones.
- 9 ○ DFW to work with land management agencies at the state, local, and federal levels to
- 10 implement deer management plans and harvest quotas that achieve desired deer
- 11 densities to maintain ecological integrity of natural communities.
- 12 ○ DFW to work with the USFWS, Department of Defense, and National Park Service to
- 13 develop effective plans to eradicate invasive non-indigenous plants on federal and
- 14 state lands and in aquatic systems that are threatening critical wildlife habitats.
- 15 ○ DFW to work with USDA through NRCS and the WHIP program to control purple
- 16 loosestrife and other invasive plants in critical wildlife habitats.
- 17 ○ DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage
- 18 Program to develop mapping of significant vegetative communities to be incorporated
- 19 as a layer within the Landscape Map. Sensitive information would be a separate layer
- 20 for use within the NJ Department of Environmental Protection only.
- 21 ○ DFW to determine groundwater recharge areas for bog turtle habitats, breeding sites
- 22 for special concern amphibians, and vernal pools with the Division of Water Quality
- 23 and the NJ Geological Survey. ENSP to expand efforts with DWQ to minimize
- 24 impacts on water quality and conduct hydrological monitoring in these areas.
- 25 ○ DFW to work with neighboring state fish and wildlife agencies to radio-track
- 26 dispersing Indiana bats across state boundaries.
- 27 ○ DFW to work with USFWS and other state and federal partners to implement North
- 28 American Waterfowl Management Plan as appropriate.
- 29 ○ DFW to work with USFWS and other state and federal partners to implement
- 30 American Woodcock Management Plan as appropriate.
- 31 ○ DFW and DEP's Water Monitoring and Standards to work together to recommend
- 32 classification upgrades in water bodies where listed or special concern species occur.
- 33 ○ DFW to partner with local, county, and state authorities to establish best management
- 34 practices in areas where listed or special concern fish, freshwater mussels, and
- 35 wildlife species occur.
- 36 ○ DFW to work with the LURP to make recommendations on stream encroachment
- 37 permit issues for areas where listed or special concern species occur.
- 38 ● DFW to lead in the development of educational materials for the public and private
- 39 landowners about wildlife of greatest conservation need and associated habitats.
- 40 ● DFW, conservation organizations, and park commissions to expand public outreach through
- 41 wildlife viewing opportunities.
- 42 ● DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat
- 43 protection and land acquisition by federal, state, and local governments through programs
- 44 such as DEP's Green Acres Program, State Agricultural Development Committee (SADC),
- 45 Farmland Preservation, local land trusts, and through mitigation.

- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Periodically monitor abundance, productivity, distribution, and trends of bog turtles, wood turtles, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years), freshwater wetland birds (2-4 years), and grassland bird, raptor, and scrub-shrub/open field bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird Survey.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- Monitor extant sites with rare mollusks.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

5. Central Highlands

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

The Central Highlands is characterized by lower elevation mountain ranges and sculpted valleys with a forest cover of mixed oak-hardwood forest and forested wetlands with patches of rocky outcroppings. This area of the Highlands physiographic province (Figure 32) includes the headwaters of the Musconetcong, South Branch of the Raritan and Lamington rivers and Pohatcong Creek and has fewer wetlands, fens, wet meadows and scrub/shrub wetlands than the Northern Highlands Zone. Vernal pools are prevalent throughout this zone. Forests become more highly fragmented in the Central Highlands although some large tracts still persist and provide habitat for area-sensitive forest species, primarily forest passerines. Agricultural fields are prevalent throughout this zone and provide habitat for grassland birds and other early succession wildlife. Abandoned iron mines exist throughout the region, and provide critical hibernacula for bats.

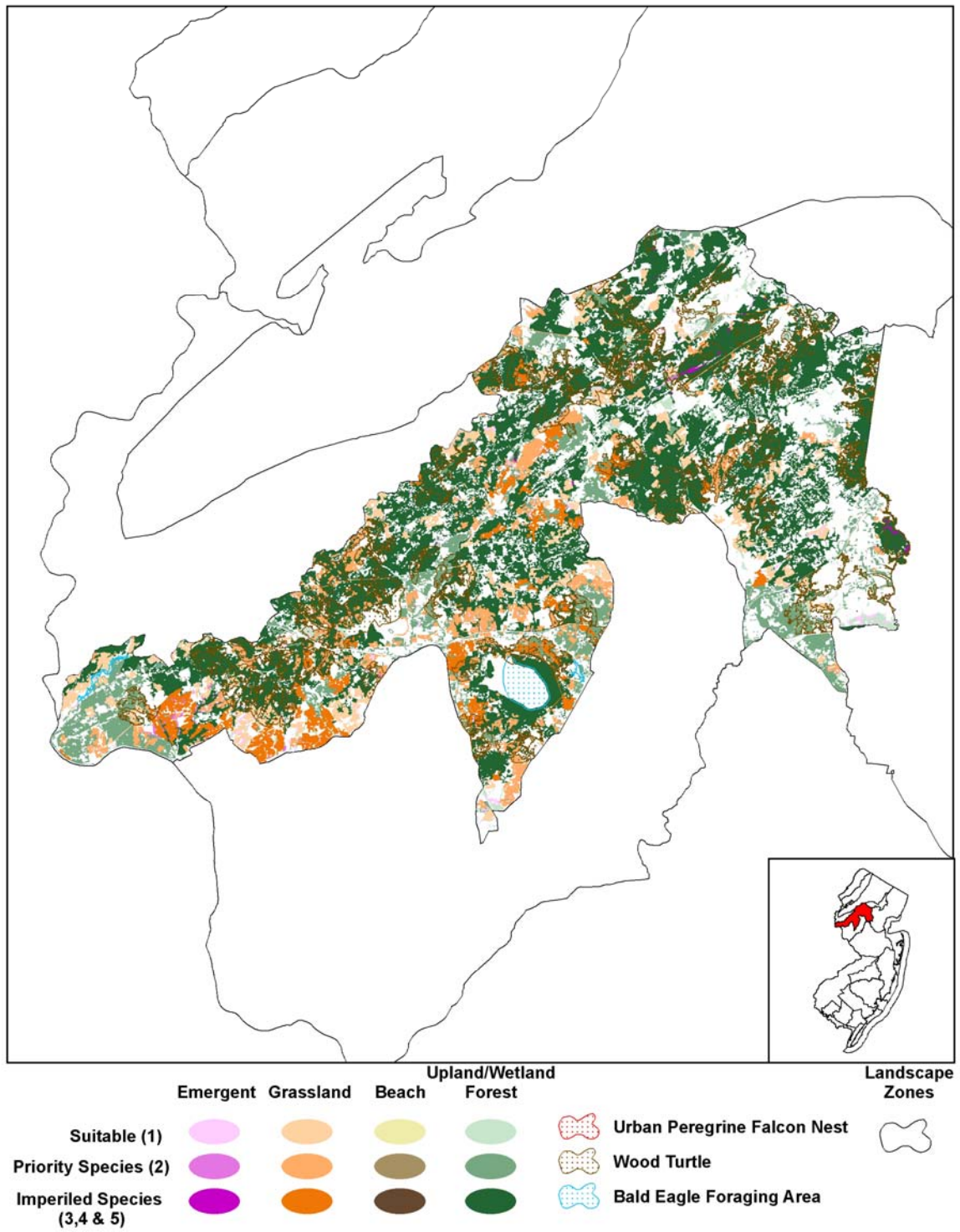
Conservation areas of opportunity in the Central Highlands include Black River WMA, Ken Lockwood Gorge WMA, Clinton WMA, Spruce Run Recreation Area, Round Valley Recreation Area, Voorhees State Park and Hacklebarney State Park.

b. Wildlife of Greatest Conservation Need

The Central Highlands support three federal endangered and threatened, eight state endangered, 11 state threatened, and 70 special concern and regional priority wildlife species, in addition to six game species of regional priority and five nongame fish species currently without state or regional status. The Indiana bat is federal endangered and the bog turtle is federal threatened. State endangered species include the bobcat, American bittern, northern harrier, red-shouldered hawk, upland sandpiper, vesper sparrow and arogos skipper. The state threatened species include the barred owl, bobolink, Cooper's hawk, red-headed woodpecker, wood turtle, grasshopper and savannah sparrows, long-eared owl and osprey. Special concern wildlife are cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, raptors, scrub-shrub/open field birds, reptiles, and amphibians.

Forest-interior wildlife take refuge in the Central Highland northern hardwood forest, including bobcats, cavity-nesters, forest-dwelling bats, forest passerines, raptors, eastern box turtles, northern copperheads, Fowler's toads, Jefferson salamanders and marbled salamanders. Due to the proximity of known hibernacula, the forests of this zone likely provide summer foraging and roosting habitat for Indiana bats. Wood turtles are found in forested wetlands. Rocky outcroppings provide habitat for bobcats and northern copperheads. Wetlands in the Central Highlands provide habitat for great blue herons, freshwater wetland birds, bog turtles, spotted turtles, damselflies, and dragonflies. Tables S37 – S43 identify the species of greatest conservation need within this zone.

1 **Figure 32.** Critical landscape habitats within the Central Highlands conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Central Highlands

Table S37. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana bat		X		X
Reptiles				
Bog turtle		X		
Insects				
American burying beetle♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S38. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				X
Birds				
American bittern		X		
Northern harrier			X	
Red-shouldered hawk				X
Short-eared owl			X	
Upland sandpiper			X	
Vesper sparrow			X	
Mollusks				
Green floater	X**			
Insects				
Arogos skipper			X	

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S39. State Threatened Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				X
Osprey		X		
Red-headed woodpecker				X
Savannah sparrow			X	
Reptiles				
Wood turtle			X	X
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S40. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Hoary bat				X**
Silver-haired bat				X**
Long-tailed (Rock) shrew				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Mammals (continued)				
Southern bog lemming				X
Birds				
Acadian flycatcher				X
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Black-billed cuckoo				X
Black-throated blue warbler				X
Blue-winged warbler				X
Broad-winged hawk				X
Brown thrasher				X
Cerulean warbler				X
Chimney swift			X	
Cliff swallow			X	
Common barn owl			X	
Common nighthawk				X
Eastern kingbird				X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Hooded warbler				X
Indigo bunting			X	
Kentucky warbler				X
Least bittern		X		
Louisiana waterthrush				X
Marsh wren		X		
Northern flicker				X
Northern parula				X
Pine warbler				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Veery				X
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle			X	X
Eastern hognose snake			X	X
Eastern ribbon snake		X	X	
Northern copperhead				X
Spotted turtle		X		
Amphibians				
Carpenter frog		X		
Fowler's toad				X
Jefferson salamander				X
Marbled salamander		X		X
Northern spring salamander		X		X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forest and Forested Wetlands
Insects				
Club dragonfly	X			X
Extra-striped snaketail	X			X
New England bluet	X	X		
Pitcher plant borer moth		X		
Schweitzer's buckmoth				X
Fish				
American brook lamprey*	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table S41. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock		X		X
Canada goose (Atlantic population)	X	X		
Wood duck	X	X		X
Virginia rail		X		
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S42. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Comely shiner	X
Cutlips minnow	X
Margined madtom	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S43. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Central Highlands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The remaining forest and grassland habitat in the Central Highlands is vulnerable to poorly planned development. Considerable habitat loss, fragmentation, and degradation already threaten forest-interior wildlife in the region. Bat hibernacula need to be identified and protected from disturbance. Wildlife in the Central Highlands are also threatened by the bioaccumulation of contaminants, human encroachment, illegal collection, ground and surface water degradation, and disease. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical grassland habitat as identified by the Landscape Project for upland sandpipers, northern harriers, vesper, grasshopper and savannah sparrows, bobolinks, special concern grassland birds and wintering raptors.
- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical forest habitat as identified by Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as the bobcat, Indiana and other forest-dwelling bats, barred owl, red-shouldered hawk, interior forest passerines, cavity nesting birds and the wood turtle. Forest patches within this zone are becoming fragmented and large contiguous parcels are somewhat rare. Protection of remaining large patches is important as well as connecting corridors.
- Identify, protect, maintain, enhance, and restore critical wetland and riparian habitats as identified by the Landscape Project for freshwater wetland birds, bog turtle, wood turtle, vernal pool breeders, special concern reptiles and amphibians, rare damselflies and dragonflies, and nongame fish. .
- Maintain and, where possible, enhance populations of endangered, threatened and special concern wildlife and fish in the Central Highlands Zone.
- Preserve the ecological quality and integrity of vernal pool communities.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Central Highlands.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public education and awareness and wildlife conservation.

1 e. Conservation Actions

Priority	Conservation Actions
Protect critical grassland habitats identified in the Landscape Project	
1°	Identify critical grassland and scrub/shrub habitats and assess their condition for nesting birds. Identify appropriate protections strategies (e.g., landowner incentives, farmland preservation, timing restrictions for mowing, cooperative agreements with utility companies for maintenance of rights-of-ways) to maintain and enhance habitat. (<i>Protect habitat – sprawl; Conserve wildlife – rare wildlife</i>)
1°	Identify core grassland habitats and work with surrounding landowners to effectively increase the functional parcel size through cooperative agreements, mowing schedules, and use of best management practices for grassland birds. (<i>Protect habitat – sprawl; Agriculture – land management</i>)
1°	Maintain connectivity of grassland and scrub-shrub habitats by identifying important corridors to maintain a system of large, connected grassland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl, migratory birds</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical forest habitats identified in the Landscape Project	
1°	Identify critical core forests and assess their suitability for interior forest wildlife. Incorporate the information into the Landscape Project and Biotics database. (<i>Protect habitat – Landscape Project</i>)
1°	Work with land managers and private landowners to maintain old growth forest stands, with large trees and large contiguous tracts of forest suitable for forest-interior species of raptors, passerines, and bobcats. Maintain and enhance floodplain, riparian and ridge-top forests for forest passerines. (<i>Silviculture – land management</i>)
1°	Maintain connectivity of forest habitats within adjacent conservation zones in the Skylands Landscape. Identify important corridors that connect large, contiguous tracts of forest. Target these areas for acquisition to maintain a system of large, connected tracts of forest. (<i>Corridors – sprawl, migratory birds</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical wetland and riparian habitats identified in the Landscape Project	
1°	Protect water quality by maintaining optimal biological buffers around wetlands, riparian and floodplain areas and minimizing destruction. (<i>Enhance habitat– private lands</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – sprawl</i>)

1

Priority	Conservation Actions (continued)
1°	Identify critical habitats and assess their condition for bog turtles. Develop protection strategies to maintain and enhance populations and habitat. (e.g., innovative public and private partnerships, provide private landowner incentives and develop cooperative agreements to protect and manage habitat). (<i>Protect habitat – Landscape Project; Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
1°	Maintain connectivity between wetland habitats by identifying important corridors to maintain a system of large, connected wetland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl, migratory birds</i>)
1°	Work with public and private landowners to maintain wetland habitat suitability for the target species. This could include such practices as controlled grazing, fencing or biological, mechanical or chemical control of harmful, invasive vegetation. (<i>Enhance habitat – private lands</i>)
1°	Develop and implement a habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. (<i>Protect habitat – fish</i>)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Native wildlife – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Monitor wildlife - fish</i>)
2°	Review and improve Landscape Project species habitat models as new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Maintain and enhance populations of endangered, threatened, and special concern wildlife and fish	
1°	Determine home range and habitat use for wood turtles. Use the information to refine GIS models and integrate into the Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. (<i>Protect habitat – Landscape Project</i>)

Priority	Conservation Actions (continued)
2°	Develop management guidelines for private landowners with significant bald eagle, bog turtle, wood turtle, cavity-nester, freshwater wetland bird, grassland bird, woodland raptor, and scrub-shrub/open field bird populations. (<i>Conserve wildlife – rare wildlife</i>)
2°	Research the intensity and characteristics of threats to wildlife and their habitat, including the causes and effects of habitat loss and degradation, edge effects, predation, disease, disturbance, contaminants, water quality, invasive plants, and hybridization. (<i>Conserve wildlife – rare wildlife</i>)
Preserve ecological integrity of vernal pool communities	
1°	Locate potential vernal pools and integrate certified vernal pools into the Department of Environmental Protection regulatory database and Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Work with Watershed Management and Land Use Regulation Program to provide optimal biological buffers to preserve the integrity of vernal pools and the surrounding upland habitat. (<i>Protect habitat – sprawl; Enhance habitat – private lands</i>)
Inventory and monitor endangered, threatened and special concern wildlife and fish	
1°	Conduct surveys for all endangered and threatened species and selected species of special concern in the Central Highlands Zone at regularly scheduled intervals to track population and habitat trend data. (<i>Monitor wildlife – long-term monitoring; Protect habitat – Landscape Project</i>)
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. (<i>Conserve wildlife – game species</i>)
1°	Conduct field sampling for listed or special concern species at areas indicated by FishTrack Database queries. (<i>Protect habitat – fish; Monitor wildlife – fish</i>)
1°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. (<i>Protect habitat – Landscape Project; Monitor wildlife – long-term monitoring</i>)
Identify and protect important bat hibernacula and foraging habitats	
1°	Survey abandoned mines and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Install bat-friendly gates on important bat winter roost sites to prevent human disturbance. (<i>Protect habitat – humans</i>)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat – humans</i>)

1

Priority	Conservation Actions (continued)
1°	Determine summer range and habitat use for Indiana bats and use the information to develop a GIS model to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting habitat and public education regarding importance of bat conservation). <i>(Protect habitat – Landscape Project)</i>
1°	Survey suitable habitats for Indiana bats and other forest-dwelling bat species to determine population distribution, status, and trends. <i>(Monitor wildlife – long-term monitoring)</i>
2°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). <i>(Conserve wildlife – rare wildlife)</i>
Identify and protect summer bat habitat	
1°	Conduct state-wide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply plastic-colored bands to Indiana bats to aid in recognition during hibernation surveys. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. <i>(Protect habitat – Landscape Project)</i>
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. <i>(Protect habitat – Landscape Project)</i>
1°	Evaluate and assess impacts of wind turbines to bat populations. <i>(Protect habitat – development)</i>
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). <i>(Protect habitat – Landscape Project)</i>
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). <i>(Conserve wildlife – rare wildlife)</i>

1

Priority	Conservation Actions (continued)
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. (<i>Protect habitat - humans</i>)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat - humans</i>)
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). (<i>Protect habitat - humans</i>)
Protect and enhance important and unique habitats	
1°	Work with state agencies and local governments to map significant natural communities within the Black River Wildlife Management Area (WMA). (<i>Protect habitat – Landscape Project</i>)
1°	Identify, protect, and enhance critical migratory stopover habitats such as the Black River WMA and Round Valley Reservoir. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Continue to support the protection of the large wetland complex of the Black River WMA. (<i>Protect habitat – development, private lands</i>)
1°	Work with local governments and NJ DEP'sNHP to protect and enhance the high quality floodplain forest natural community at the Black River WMA. (<i>Protect habitat –development, sprawl; Enhance habitat – development, private lands</i>)
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Evaluate restoration - deer</i>)
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. (<i>Conserve wildlife - deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck”). (<i>Conserve wildlife - deer</i>)
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. (<i>Conserve wildlife – invasives</i>)

1

Priority	Conservation Actions (continued)
1°	Work with land management agencies to identify areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation. Prioritize areas for control projects. <i>(Conserve wildlife – invasives)</i>
1°	Collaborate with land managers to determine the appropriate physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. <i>(Conserve wildlife – invasives)</i>
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. <i>(Conserve wildlife – cats, subsidized predators)</i>
1°	Work with land management agencies to survey and monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Collaborate with land management agencies on appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. <i>(Conserve wildlife – invasives)</i>
Promote public education and viewing opportunities	
1°	Develop and maintain education materials and viewing opportunities for the public to promote public awareness of wildlife conservation and environmental issues. <i>(Education – humans)</i>
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. <i>(Education – humans)</i>
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. <i>(Education – humans; Conserve wildlife – invasives)</i>
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. <i>(Education – humans)</i>
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. <i>(Education – humans; Protect habitat – fish)</i>

2

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field birds.
 - Utilize incentive programs that encourage the management of grassland and scrub/shrub communities and the conservation of bog turtles, and to protect water quality and riparian habitat in areas where rare mussels occur.
 - Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of grassland and scrub/shrub communities and bog turtles.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer and winter bat habitat.
 - Develop/maintain cooperative relationships with private landowners with bog turtles on their land.
 - Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
 - In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for butterfly and moth species
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration.
 - Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species.
- Consult with conservation organizations to develop educational programs.
- Encourage the use of Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, NRCS, USFWS - NJ Field Office, and USDA, and the DCA, Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP)-Division of Fish and Wildlife (DFW) to protect cavity-nester and raptor nesting and foraging sites.
 - DFW to monitor bat hibernacula for disturbance during critical times.
 - DFW to develop a plan to protect sensitive bog turtle, timber rattlesnake, and wood turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.
 - DFW and conservation organizations to work with the DEP's Land Use Regulation Program to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
 - Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, raptors, and other forest-dwelling species, and freshwater wetland birds on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/ scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
 - DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels and rare fish species.
 - DFW to develop specific conservation plans for special concern reptiles and amphibians on state lands.
 - DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.

- DFW will integrate results of vegetative structure in response to deer densities into deer management strategies within deer management zones.
 - DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
 - DFW to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
 - DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
 - DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage Program to develop mapping of significant vegetative communities to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
 - DFW to determine groundwater recharge areas for bog turtle habitats and vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
 - DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
 - DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
 - DFW to work with USFWS and other state and federal partners to implement American Woodcock Management Plan as appropriate.
 - DFW and DEP's Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
 - DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
 - DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
 - DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
 - DFW, conservation organizations, and park commissions to expand public outreach through wildlife viewing opportunities.
 - DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, and local land trusts, and through mitigation.
 - DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.
- g. Monitoring Success**
- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
 - Determine distribution, occurrence, and monitor bobcats.

- 1 • Annually monitor abundance, productivity, distribution, and trends of bog turtles, wood
2 turtles, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years),
3 freshwater wetland birds (2-4 years), and grassland bird, raptor, and scrub-shrub/open field
4 bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird
5 Survey.
- 6 • Sponsor “Hawk Watches” for raptor monitoring during the fall migration.
- 7 • Continue the long-term monitoring of reptile and amphibian populations through the Herp
8 Atlas Project, the Calling Amphibian Monitoring Program, and the vernal pool project.
- 9 • Work with volunteers, private landowners and conservation groups to monitor the success of
10 eradication/control projects that target invasive non-indigenous plants.
- 11 • Continue to monitor deer densities and deer harvest data.
- 12 • Monitor populations of breeding, migratory and wintering waterfowl of conservation
13 concern.
- 14 • Develop indicator metrics for monitoring forest health and implement at the scale necessary
15 to monitor effectiveness of deer management strategies.
- 16
- 17
- 18

6. Urban Highlands

- a. *Habitats*
- b. *Wildlife of Greatest Conservation Need*
- c. *Threats to Wildlife and Associated Habitats*
- d. *Conservation Goals*
- e. *Conservation Actions*
- f. *Potential Partnerships to Deliver Conservation*
- g. *Monitoring Success*

a. Habitats

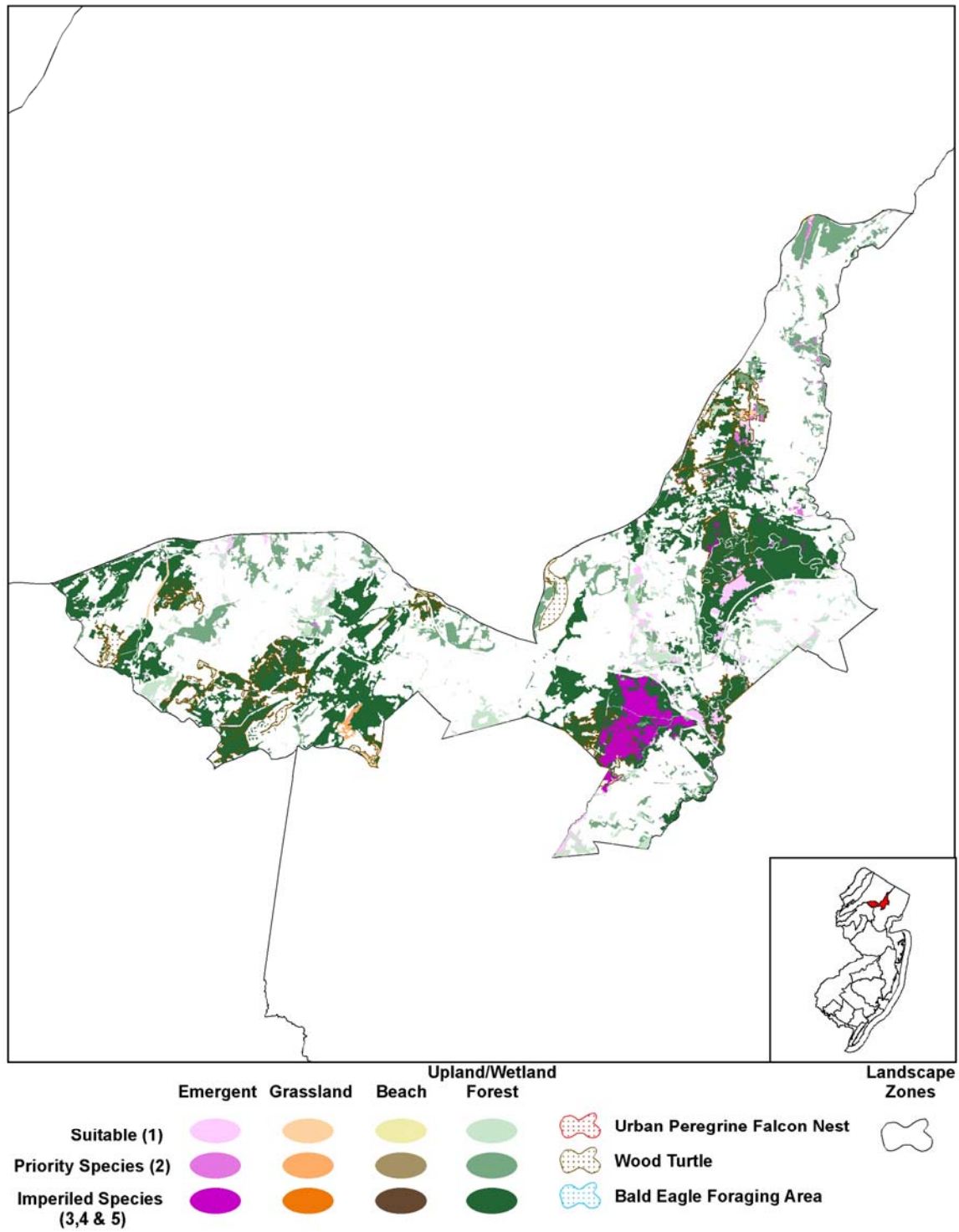
The Urban Highlands Zone is located in the central portion of Morris County and extends eastward along the Interstate 80 corridor to the county border, and then north along the Interstate 287 corridor into portions of Passaic and western Bergen counties (Figure 33). The zone is characterized by extensive development that has resulted in a highly fragmented landscape containing few areas of contiguous habitat. The remaining habitat consists primarily of floodplain forests and forested and emergent wetlands. The floodplains are prone to frequent flooding and therefore are unlikely to be developed in the future.

Publicly owned land in the Urban Highlands Zone is scarce. However, conservation areas of opportunity include Great Piece Meadows, Bog and Vly Meadows, Troy Meadows and Hatfield Swamp.

b. Wildlife of Greatest Conservation Need

The Urban Highlands support two federal endangered and threatened, nine state endangered, seven state threatened, and 51 special concern and regional priority wildlife species, in addition to six game species of regional priority and three nongame fish species currently without state or regional status. The Indiana bat is federal endangered. State endangered species include the bobcat, northern harrier, red-shouldered hawk, short-eared owl, pied-billed grebe, blue-spotted salamander, green floater and Appalachian grizzled skipper. The state threatened species include the barred owl, Cooper's hawk, long-eared owl, red-headed woodpecker, wood turtle, tidewater mucket and yellow lampmussel. Special concern wildlife are cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, raptors, scrub-shrub/open field birds, reptiles, and amphibians. Tables S44 – S50 identify the species of greatest conservation need within this zone.

1 **Figure 33.** Critical landscape habitats within the Urban Highlands conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Urban Highlands

Table S44. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat		X		X**
Insects				
American burying beetle♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S45. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Bobcat				X
Black-crowned night-heron		X		
Northern harrier		X	X	
Pied-billed grebe		X		
Red-shouldered hawk				X
Short-eared owl		X	X	
Amphibians				
Blue-spotted salamander				X
Mollusks				
Green floater	X**			
Insects				
Appalachian grizzled skipper			X	

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S46. State Threatened Species

Common Name	Water	Emergent Wetland	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Cooper's hawk				X
Long-eared owl				X
Red-headed woodpecker				X
Reptile				
Wood turtle				X
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S47. Nongame Species of Conservation Concern

Common Name	Water	Emergent Wetland	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Hoary bat				X**
Silvered-haired b at				X**
Long-tailed (Rock) shrew				X
Southern bog lemming			X	X
Birds				
American golden-plover				
Baltimore oriole				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Emergent Wetland	Grasslands	Forests and Forested Wetlands
Birds (continued)				
Black-and-white warbler				X
Blue-winged warbler				X
Brown thrasher				X
Chimney swift				X
Cliff swallow			X	
Common barn owl			X	
Common nighthawk				X
Eastern kingbird				X
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Indigo bunting			X	
Least bittern		X		
Northern flicker				X
Pine warbler				X
Prairie warbler				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Veery				X
Willow flycatcher				X
Wood thrush				X
Yellow-bellied sapsucker				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X
Eastern hognose snake			X	X
Eastern ribbon snake		X	X	
Northern copperhead				X
Amphibians				
Fowler's toad				X
Jefferson salamander				X
Marbled salamander				X
Insects				
Club dragonfly	X			X
Extra-striped snaketail	X			X
New England bluet	X	X		
Pitcher plant borer moth		X		
Schweitzer's buckmoth				X
Fish				
American brook lamprey*	X			

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3
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*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table S48. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock		X	X	X
Canada goose (Atlantic population)	X	X		
Virginia rail		X		
Wood duck	X	X		X
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S49. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Cutlips minnow	X
Margined madtom	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S50. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Urban Highlands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

The remaining forest, grassland and wetland habitat in the Urban Highlands exist primarily in areas not conducive to development due to high water tables and frequent flooding. Some large forested wetland tracts remain in the area mentioned above and provide remnant habitat for area-sensitive forest species. Much of the zone is already developed and only small, highly fragmented patches of upland habitat remain interspersed throughout. Considerable habitat loss, fragmentation, and degradation already threaten forest-interior wildlife in the region. Wildlife in the Urban Highlands is threatened by the bioaccumulation of contaminants, human

encroachment, ground and surface water degradation, and disease. Also see Section I-E “Threats to Wildlife and Habitats” (page 16) of this document.

d. Conservation Goals

- Identify, protect, maintain, enhance, and restore large tracts of critical forest and wetland forest habitat as identified by Landscape Project for area-sensitive species such as the barred owl, red-shouldered hawk and bobcat.
- Identify, protect, maintain, enhance, and restore critical wetland and riparian habitats as identified by Landscape Project for freshwater wetland birds, wood turtle, vernal pool breeders, special concern reptiles and amphibians, rare damselflies and dragonflies, and nongame fish.
- Maintain and, where possible, enhance populations of endangered, threatened and special concern wildlife and fish species in the Urban Highlands Zone.
- Preserve the ecological quality and integrity of vernal pool communities.
- Inventory, determine distribution, and monitor wildlife (including nongame fish species) of greatest conservation need in the Urban Highlands.
- Identify summer distribution, habitat use and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public education and viewing opportunities.

e. Conservation Actions

Priority	Conservation Action
Protect critical forest habitats identified in the Landscape Project	
1°	Identify critical core forests and assess their suitability for interior forest wildlife. Incorporate the information into the Landscape Project and Biotics database. <i>(Protect habitat – Landscape Project)</i>
1°	Work with land managers and private landowners to maintain old growth forest stands, with large trees and large contiguous tracts of forest suitable for forest-interior species of raptors, passerines, and bobcats. Maintain and enhance floodplain forests for forest passerines. Maintain crown closures > 80%. <i>(Silviculture – land management; Enhance habitat – private lands)</i>
1°	Maintain connectivity of forest habitats within adjacent conservation zones in the Skylands Landscape. Identify important corridors that connect large, contiguous tracts of forest. Target these areas for acquisition to maintain a system of large, connected tracts of forest. <i>(Corridors - sprawl)</i>
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. <i>(Protect habitat – Landscape Project)</i>

1

Priority	Conservation Action (continued)
Protect critical wetland and riparian habitats identified in the Landscape Project	
1°	Protect water quality by maintaining optimal biological buffers around wetlands, riparian and floodplain areas and minimizing destruction. (<i>Protect habitat - sprawl</i>)
1°	Prevent runoff and sedimentation by maintaining riparian areas through stream bank restoration efforts. (<i>Protect habitat – fish; Enhance habitat – odonata</i>)
1°	Identify critical habitats and assess their condition for northern harriers, barred owls and wood turtles. Develop protection strategies to maintain and enhance populations and habitat. (e.g., innovative public and private partnerships, provide private landowner incentives and develop cooperative agreements to protect and manage habitat). (<i>Protect habitat – Landscape Project; Enhance habitat – private lands</i>)
1°	Maintain connectivity between wetland habitats by identifying important corridors to maintain a system of large, connected wetland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors - sprawl</i>)
1°	Work with public and private landowners to maintain wetland habitat suitability for the target species. This could include such practices as controlled grazing, fencing or biological, mechanical or chemical control of harmful, invasive vegetation. (<i>Enhance habitat –private lands</i>)
1°	Develop and implement a habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. (<i>Protect habitat – fish</i>)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat – fish</i>)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Protect habitat – fish, Landscape Project</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Maintain and enhance populations of endangered, threatened and special concern wildlife and fish	
1°	Determine home range and habitat use for wood turtles. Use the information to refine GIS models and integrate into the Landscape Project. (<i>Protect habitat – Landscape Project</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)

Priority	Conservation Action (continued)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. <i>(Protect habitat – fish)</i>
1°	Reclaim degraded habitats by working with land management agencies to determine the appropriate control methods for eliminating harmful, invasive, non-native vegetation. Restore native vegetation, especially in large wetland complexes throughout the Urban Highlands Zone. <i>(Evaluate restoration – invasives)</i>
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. <i>(Protect habitat – Landscape Project)</i>
2°	Develop management guidelines for private landowners with significant rare species populations. <i>(Conserve wildlife – rare wildlife; Enhance habitat – private lands)</i>
2°	Research the intensity and characteristics of threats to wildlife and their habitat, including the causes and effects of habitat loss and degradation, edge effects, predation, disease, disturbance, contaminants, water quality, invasive plants, and hybridization. <i>(Protect wildlife – humans; Protect habitat – humans)</i>
Preserve ecological integrity of vernal pool communities	
1°	Locate potential vernal pools and integrate certified vernal pools into the Department of Environmental Protection regulatory database and Landscape Project. <i>(Protect habitat – Landscape Project)</i>
1°	Work with Watershed Management and Land Use Regulation Program to provide optimal biological buffers to preserve the integrity of vernal pools and the surrounding upland habitat for blue-spotted salamanders and other vernal pool species. <i>(Protect habitat – development)</i>
Inventory and monitor endangered, threatened and special concern wildlife and fish	
1°	Conduct the annual Mid-Winter Waterfowl Survey. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. <i>(Conserve wildlife – game species)</i>
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. <i>(Conserve wildlife – game species)</i>
1°	Conduct surveys for all endangered and threatened species and selected species of special concern in the Urban Highlands Zone at regularly scheduled intervals to track population and habitat trend data. <i>(Monitor wildlife – long-term monitoring)</i>
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. <i>(Monitor wildlife – long-term monitoring)</i>

1

Priority	Conservation Action (continued)
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply colored plastic bands to Indiana bats to aid in recognition during hibernation surveys. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. <i>(Protect habitat – Landscape Project)</i>
1°	Conduct telemetries study during summer months to determine roost characteristics and habitat requirements for maternity colonies. <i>(Protect habitat – Landscape Project)</i>
1°	Evaluate and assess impacts of wind turbines to populations of bats. <i>(Protect habitat – development)</i>
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). <i>(Protect habitat – Landscape Project)</i>
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). <i>(Protect habitat – Landscape Project)</i>
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. <i>(Monitor wildlife – long-term monitoring)</i>
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. <i>(Protect habitat - humans)</i>
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. <i>(Protect habitat - humans)</i>
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). <i>(Protect habitat - humans)</i>

1

Priority	Conservation Action (continued)
Protect and enhance important and unique habitats	
1°	Work with state agencies and local governments to map significant natural communities in Great Piece Meadows, Bog & Vly Meadows, and Troy Meadows. <i>(Protect habitat – Landscape Project)</i>
1°	Identify, protect, and enhance critical migratory stopover habitats such as Great Piece Meadows, Bog & Vly Meadows, and Troy Meadows. <i>(Protect habitat – migratory birds; Corridors – migratory birds)</i>
1°	Continue to support the protection of the large wetland complexes of the Great Piece Meadows, Bog & Vly Meadows, and Troy Meadows. <i>(Protect habitat – development, sprawl)</i>
1°	Work with local governments and NHP to protect and enhance the natural community and endangered plant species at Great Piece Meadows, Bog & Vly Meadows, and Troy Meadows. <i>(Protect habitat – development, sprawl)</i>
1°	Work with local governments and NJ DEP's NHP to protect and enhance the high quality floodplain forest natural community at Great Piece Meadows, Bog & Vly Meadows, and Troy Meadows. <i>(Protect habitat – development, sprawl; Enhance habitat – development, private lands)</i>
1°	Work with local governments and NHP to protect and enhance the hardwood swamp natural community and federal threatened plant species at Great Piece Meadows, Bog & Vly Meadows, and Troy Meadows. <i>(Protect habitat – humans, development, sprawl; Enhance habitat – development, private lands)</i>
Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife	
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. <i>(Conserve wildlife - deer)</i>
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. <i>(Conserve wildlife - deer)</i>
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck”). <i>(Conserve wildlife - deer)</i>
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. <i>(Conserve wildlife – invasives)</i>
1°	Work with land management agencies to locate areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation. Prioritize areas for control projects. <i>(Conserve wildlife – invasives)</i>

1

Priority	Conservation Action (continued)
1°	Collaborate with public and private landowners to determine the appropriate physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives; Conserve wildlife – rare wildlife</i>)
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. (<i>Conserve Wildlife – cats, subsidized predators</i>)
1°	Work with land management agencies to survey and monitor for the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Collaborate to determine the appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
Promote public education and viewing opportunities	
1°	Develop and maintain education materials and viewing opportunities for the public to promote public awareness of wildlife conservation and environmental issues. (<i>Education – humans</i>)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve the public in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. (<i>Education – humans; Conserve wildlife – invasives</i>)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)

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f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub/open field birds.
 - Utilize incentive programs that encourage the management of forest communities, and to protect water quality and riparian habitat in areas where rare mussels occur.

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- Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of forest communities. Develop/maintain cooperative relationships with private landowners with bog turtles on their land.
- Develop and implement landowner incentives for providing, maintaining, and protecting summer and winter bat habitat.
- Work with landowners to inventory their properties for the presence and severity of non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.
- In the context of landowner incentive programs such as LIP and Forestry Stewardship, work with landowners to develop and implement deer management plans that achieve desired deer densities.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short- and long-term monitoring goals.
 - Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
 - Recruit North American Butterfly Association volunteers to conduct surveys for butterfly and moth species.
 - Involve Citizen Scientists in conservation projects, such as stream bank restoration.
 - Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species.
- Consult with conservation organizations to develop educational programs.

- Encourage the use of Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of invasions of invasive non-indigenous plants.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, NRCS, USFWS - NJ Field Office, and USDA, and the DCA, Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) protect cavity-nester and raptor nesting and foraging sites.
 - DFW to develop a plan to protect sensitive bog turtle and wood turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle, timber rattlesnake, and wood turtle sites.
 - DFW and conservation organizations to work with the DEP's Land Use Regulation Program (LURP) to protect and appropriately classify wetlands for blue-spotted salamanders and special concern reptile and amphibian populations.
 - Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and other forest-dwelling species on state lands and with natural resource managers, county and municipal utility authorities and planners.
 - DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels and rare fish species.
 - DFW to develop specific conservation plans for special concern reptiles and amphibians on state lands.
 - DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
 - DFW will integrate results of vegetative structure in response to deer densities into deer management strategies within deer management zones.
 - DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
 - DFW to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
 - DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.

- DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage Program (NHP) to develop mapping of significant vegetative communities to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
 - DFW to determine groundwater recharge areas for bog turtle habitats and vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
 - DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
 - DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
 - DFW to work with USFWS and other state and federal partners to implement American Woodcock Management Plan as appropriate.
 - DFW and DEP's Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
 - DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
 - DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
 - DFW to work with the State Planning Commission, the Office of Smart Growth and local governments to protect critical wildlife habitat and unique communities through the designation of Special Resource Areas within the State Development and Redevelopment Plan.
 - DFW to work with the newly created Highlands Council to implement the Landscape Project within the Highlands Region. Work with the Council to designate "no build zones" in the preservation area that are identified as critical habitat on the Landscape maps. Help to identify conservation areas in the surrounding planning area based on Landscape maps.
 - DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
 - DFW, conservation organizations, and park commissions to expand public outreach through wildlife viewing opportunities.
 - DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, and local land trusts, and through mitigation.
 - DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.
- g. Monitoring Success**
- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
 - Annually monitor abundance, productivity, distribution, and trends of wood turtles, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2 – 4 years), freshwater

1 wetland birds (2 – 4 years), and raptor and scrub-shrub/open field bird communities (2 – 4
2 years), particularly in areas beyond the reach of the Breeding Bird Survey.

- 3 • Continue the long-term monitoring of reptile and amphibian populations through the Herp
- 4 Atlas Project, the Calling Amphibian Monitoring Program, and the Vernal Pool Project
- 5 • Work with volunteers, private landowners and conservation groups to monitor the success of
- 6 eradication/control projects that target invasive non-indigenous plants.
- 7 • Continue to monitor deer densities and deer harvest data.
- 8 • Monitor populations of breeding, migratory and wintering waterfowl of conservation
- 9 concern.
- 10 • Develop indicator metrics for monitoring forest health and implement at the scale necessary
- 11 to monitor effectiveness of deer management strategies.

7. Southern Highlands

- a. Habitats*
- b. Wildlife of Greatest Conservation Need*
- c. Threats to Wildlife and Associated Habitats*
- d. Conservation Goals*
- e. Conservation Actions*
- f. Potential Partnerships to Deliver Conservation*
- g. Monitoring Success*

a. Habitats

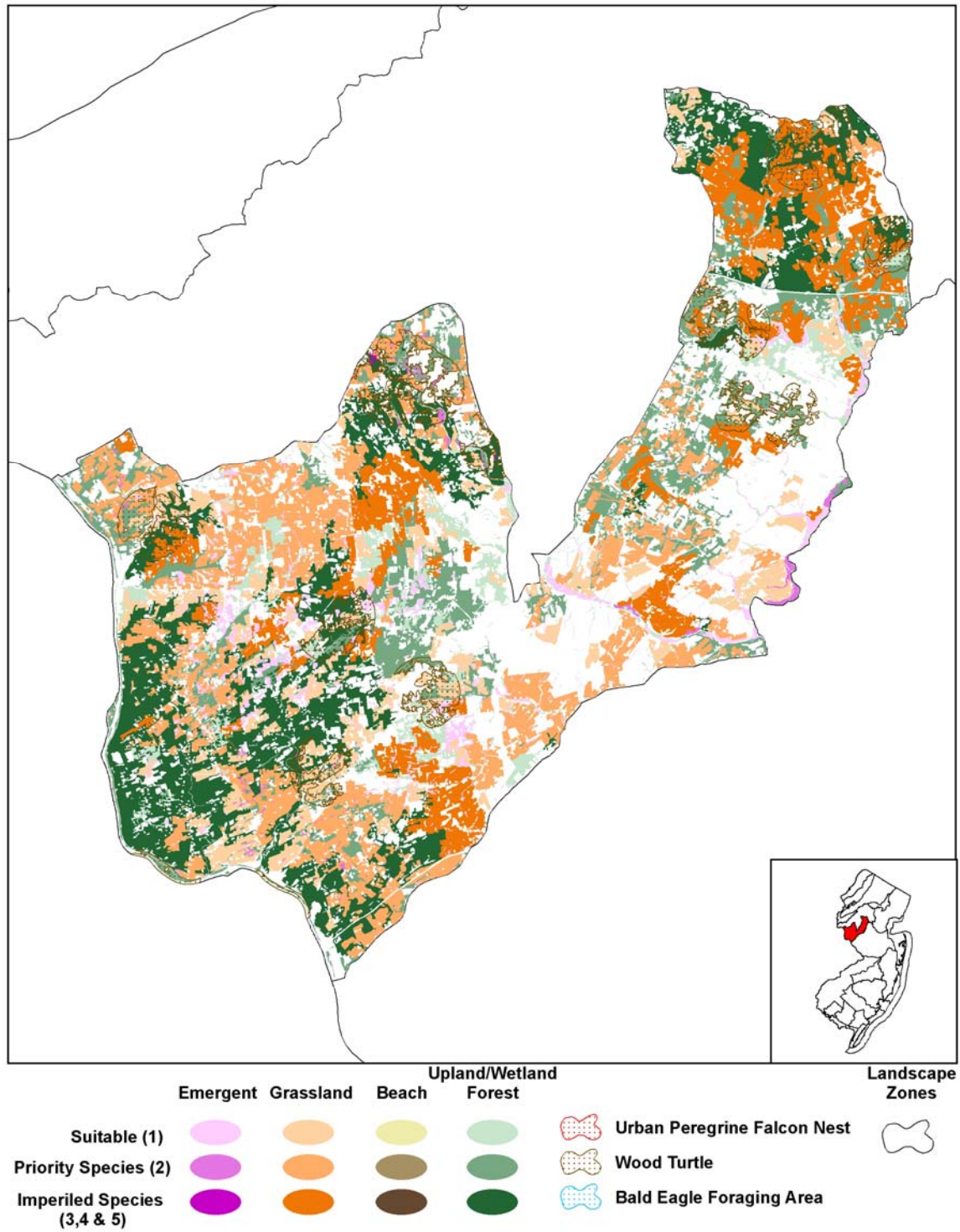
The Southern Highlands Zone is located primarily in southern Hunterdon and extreme eastern Somerset counties (Figure 34). Agricultural fields of cropland and pastures dominate the area. The remaining forest habitat is highly fragmented and exists primarily as small patches interspersed by development and agriculture. Forested ravines exist in the western portion of the zone where small tributary streams flow into the Delaware River. Floodplain forests exist along the Delaware River and provide important habitat to migrating birds. Scattered emergent wetlands occur throughout the zone but many have been impacted by human activity and development.

Very little publicly owned land exists in this zone. Conservation areas of opportunity include the D& R Canal and Bull's Island State Park.

b. Wildlife of Greatest Conservation Need

The Southern Highlands supports two federal endangered and threatened, six state endangered, 11 state threatened, and 57 special concern and regional priority wildlife species, in addition to six game species of regional priority and six nongame fish species currently without state or regional status. The Bog turtle is the federally threatened species. The red-shouldered hawk, northern harrier, short-eared owl, upland sandpiper, vesper sparrow, green floater and Appalachian grizzled skipper are state endangered species. State threatened wildlife include the barred owl, Cooper's hawk, long-eared owl, osprey, bobolink, grasshopper sparrow, savannah sparrow, wood turtle, long-tailed salamander, tidewater mucket and yellow lampmussel. Special concern wildlife are cavity-nesters, colonial waterbirds, forest passerines, freshwater wetland birds, grassland birds, raptors, and scrub-shrub birds. Tables S51 – S57 identify the species of greatest conservation need within this zone.

1 **Figure 34.** Critical landscape habitats within the Southern Highlands conservation zone, as
 2 identified through the Landscape Map (v2).



Wildlife Species and Associated Habitats of the Southern Highlands

Table S51. Federal Endangered and Threatened Species*

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Indiana Bat		X		X**
Reptiles				
Bog turtle		X		
Insects				
American burying beetle♦			X	

*All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife

**Potential presence.

♦Only historic records exist. Species believed to be extirpated.

X: Species occurs within the identified habitat.

Table S52. State Endangered Species

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Northern harrier		X	X	
Short-eared owl			X	
Upland sandpiper			X	
Vesper sparrow			X	
Mollusks				
Green floater	X**			
Insects				
Appalachian grizzled skipper			X	

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S53. State Threatened Species

Common Name	Water	Emergent Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Barred owl				X
Bobolink			X	
Cooper's hawk				X
Grasshopper sparrow			X	
Long-eared owl				X
Osprey		X		
Savannah sparrow			X	
Reptiles				
Wood turtle				X
Amphibians				
Long-tailed salamander				X
Mollusks				
Tidewater mucket	X**			
Yellow lampmussel	X**			

**Riverine habitat, within Landscape Map, these species are identified within the "Emergent Wetlands" layer

X: Species occurs within the identified habitat.

Table S54. Nongame Species of Conservation Concern

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
Eastern small-footed bat				X**
Eastern red bat				X**
Hoary bat				X**
Silver-haired bat				X**
Long-tailed (Rock) shrew				X
Southern bog lemming				X

1 Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
Acadian flycatcher				X
American golden-plover		X		
American kestrel			X	
Baltimore oriole				X
Black-and-white warbler				X
Blue-winged warbler				X
Brown thrasher				X
Chimney swift				X
Cliff swallow			X	
Common barn owl			X	
Common nighthawk				X
Eastern kingbird				X
Eastern meadowlark			X	
Eastern screech-owl				X
Eastern towhee				X
Eastern wood-pewee				X
Field sparrow			X	
Gray catbird				X
Gray-cheeked thrush				X
Great blue heron		X		X
Great crested flycatcher				X
Green heron		X		
Hooded warbler				X
Indigo bunting			X	
Kentucky warbler				X
Louisiana waterthrush				X
Northern flicker				X
Northern parula				X
Prairie warbler				X
Purple finch				X
Rose-breasted grosbeak				X
Scarlet tanager				X
Sharp-shinned hawk				X
Veery				X
Willow flycatcher				X
Wood thrush				X
Worm-eating warbler				X
Yellow-bellied sapsucker				X
Yellow-throated vireo				X
Yellow-throated warbler				X
Reptiles				
Eastern box turtle				X
Eastern hognose snake			X	X
Eastern ribbon snake		X	X	
Northern copperhead				X
Spotted turtle		X		
Amphibians				
Carpenter frog		X		
Fowler's toad				X
Jefferson salamander				X
Marbled salamander		X		X
Northern spring salamander				X
Insects				
Club dragonfly	X			X
Extra-striped snaketail	X			X
New England bluet	X	X		
Pitcher plant borer moth		X		
Schweitzer's buckmoth				X

Nongame Species of Conservation Concern (continued)

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Fish				
American brook lamprey*	X			
Bridle shiner	X			

*Species is also recognized as target species of ecoregional concern by the Nature Conservancy-NJ Chapter

**Potential presence.

X: Species occurs within the identified habitat.

Table S55. Game Species of Regional Priority

Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Birds				
American black duck	X	X		
American woodcock			X	X
Canada goose (Atlantic population)	X	X		
Virginia rail		X		
Wood duck	X	X		X
Fish				
Brook trout*	X			

*Species is an excellent indicator of water quality.

X: Species occurs within the identified habitat.

Table S56. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Water
Fish	
Comely shiner	X
Cutlips minnow	X
Hickory shad	X
Margined madtom	X
Shield darter	X
Slimy sculpin	X

X: Species occurs within the identified habitat.

Table S57. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by NJDFW to be species of concern.

Common Name	Water	Wetlands	Grasslands	Forests and Forested Wetlands
Mammals				
River otter	X	X		X
Birds				
Ruffed grouse				X
Sora rail		X		
Fish				
Brown trout*	X			
Rainbow trout*	X			

*Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

X: Species occurs within the identified habitat.

c. Threats to the Wildlife and Habitats of the Southern Highlands

For complete literature review on the impacts of habitat loss and fragmentation, please see New Jersey's Landscape Project Report, Appendix IV or visit our website:

www.njfishandwildlife.com/ensp/landscape/lp_report.pdf

Encroaching development, disturbance, habitat loss, fragmentation, and degradation threaten the wildlife of the Southern Highlands Zone. Invasive plants alter wet meadows that are bog turtle habitat. The use of pesticides, mowing, and other agricultural practices endanger grassland birds and their habitats. Illegal collection and road mortality impact bog turtles and wood turtles. Also see Section I-E "Threats to Wildlife and Habitats" (page 16) of this document.

d. Conservation Goals

- Identify, protect, maintain, enhance, and restore large contiguous tracts of critical grassland habitat as identified by the Landscape Project for upland sandpipers, northern harriers, vesper, grasshopper and savannah sparrows, bobolinks, special concern grassland birds, wintering raptors and special concern butterflies and moths.
- Identify, protect, enhance, and restore important riverine and riparian habitats for green floaters and other rare mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes, and rare damselflies and dragonflies.
- Identify, protect, maintain, enhance, and restore the remaining large contiguous tracts of forest as identified by the Landscape Project for the long-term viability of forest-dwelling, area-sensitive and interior-nesting wildlife. These include such species or suites as the Cooper's hawk, red-headed woodpecker, interior forest passerines and cavity nesting birds.
- Identify, protect, maintain, enhance, and restore critical wetland habitats as identified by the Landscape Project for bog turtles, wood turtles and long-tailed salamanders, vernal pool breeders, special concern reptiles and amphibians, and rare damselflies and dragonflies.
- Inventory and monitor all endangered, threatened and special concern wildlife (including nongame fish species) in the zone.
- Maintain and, where possible, enhance populations of endangered, threatened, and special concern wildlife and fish species in the zone.
- Identify summer distribution, habitat use, and migratory corridors of bat species found within New Jersey; develop and implement strategies for protecting summer bat habitat.
- Identify and protect hibernation sites for Indiana bat and other winter resident bat species within New Jersey.
- Maintain the ecological integrity of natural communities and regional biodiversity by controlling invasive species and overabundant wildlife.
- Promote public education and awareness and wildlife conservation.

1 e. Conservation Strategies

Priority	Conservation Actions
Protect critical grassland and scrub/shrub habitats identified in the Landscape Project	
1°	Identify critical grassland and scrub/shrub habitats and assess their condition for nesting birds. Identify appropriate protection strategies (e.g., landowner incentives, farmland preservation, timing restrictions for mowing, cooperative agreements with utility companies for maintenance of rights-of-ways) to maintain and enhance habitat. (<i>Agriculture – land management; Enhance habitat – private lands</i>)
1°	Maintain connectivity of grassland and scrub-shrub habitats by identifying important corridors to maintain a system of large, connected grassland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl, migratory birds</i>)
2°	Review and improve Landscape Project species habitat models and new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical riverine and riparian habitats	
1°	Identify critical habitats for special concern mollusks, wood turtles, special concern reptiles and amphibians, nongame fishes and special concern damselflies and dragonflies and assess their condition for maintaining populations. Work with the Bureau of Freshwater fisheries to identify critical nongame fish habitat. (<i>Protect habitat – fish; Conserve wildlife – rare wildlife</i>)
1°	Implement actions to restore, maintain and/or protect riverine habitat, as appropriate, for target species. Actions can include acquisition, landowner incentives for protection and management, livestock fencing and no-mow riparian buffers. (<i>Agriculture – land management; Silviculture – land management; Corridors – migratory birds</i>)
1°	Assess specific threats to nongame fishes, wood turtles and other target species and take the necessary actions to restore, maintain, enhance, and protect habitat, as appropriate. Recommend Category One classification for streams supporting populations. Work with public and private landowners to protect and manage riparian habitat to maintain water quality and reduce siltation. (<i>Conserve wildlife – rare wildlife; Protect habitat – fish, mussels</i>)
1°	Work with NJDOT to encourage spanning rivers and streams, when feasible, to avoid disturbance of streambeds and riparian habitat and to provide travel corridors for terrestrial wildlife. (<i>Corridors – sprawl; Conserve wildlife – rare wildlife; Protect habitat – fish, mussels</i>)
1°	Develop and implement a habitat improvement and restoration programs for coldwater fish species' habitats and ecosystems. (<i>Protect habitat – fish</i>)
1°	Continue to classify waters according to their suitability for trout, and provide recommendations for surface water classification changes to the Department of Environmental Protection. (<i>Protect habitat – fish</i>)
1°	Perform QA/QC of the NJDEP - DFW, Bureau of Freshwater Fisheries' FishTrack Database and write queries to determine distributions of fishes identified as special concern by the Delphi process. (<i>Protect habitat – fish</i>)

1

Priority	Conservation Actions (continued)
1°	Plot distributions of special concern fish species, and integrate those data into the Landscape Project's habitat mapping. (<i>Protect habitat – fish, Landscape Project</i>)
Protect critical forest habitats identified in the Landscape Project	
1°	Work with public and private land managers to maintain large, contiguous tracts of forests that provide suitable habitat for interior forest species. Encourage the maintenance of old-growth stands, uneven-aged stand management and the retention of dead standing and fallen trees. Discourage forestry practices in forested wetlands. Maintain crown closures at > 80% for interior forest species. (<i>Silviculture – land management; Enhance habitat – private lands; Conserve wildlife – rare wildlife</i>)
1°	Work with the Bureau of Wildlife Management to identify areas (primarily refuge areas where hunting is prohibited) where deer densities exist at unhealthy levels and develop a strategy to reduce deer numbers and maintain them at acceptable levels that encourage natural forest regeneration. (<i>Conserve wildlife - deer</i>)
1°	Provide incentives for private landowners to maintain or enhance their forests for wildlife values through such programs as LIP, WHIP and Forestry Stewardship Program. (<i>Agriculture – land management; Silviculture – land management, Enhance habitat – private lands</i>)
1°	Maintain connectivity of forest habitats within adjacent conservation zones in the Skylands Landscape. Identify important corridors that connect large, contiguous tracts of forest. Target these areas for acquisition to maintain a system of large, connected tracts of forest. (<i>Corridors – sprawl, migratory birds</i>)
2°	Review and improve Landscape Project species habitat models as new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Protect critical wetland habitats identified in the Landscape Project	
1°	Identify critical wetland habitats and assess their suitability for bog turtles and/or other wetland dependent species. Develop and implement strategies to restore, maintain and/or enhance habitat, as appropriate. Actions can include landowner incentives to manage or protect habitat, fencing and grazing, maintaining protective buffers, and eliminating invasive, non-native vegetation. (<i>Protect habitat – Landscape Project</i>)
1°	Maintain connectivity between wetland habitats by identifying important corridors to maintain a system of large, connected wetland habitats. Target these areas for acquisition or work with public and private landowners to maintain the corridors. (<i>Corridors – sprawl; Enhance habitat – private lands</i>)
1°	Work with public and private landowners to maintain wetland habitat suitability for the target species. Actions could include controlled grazing, fencing or biological, mechanical or chemical control of harmful, invasive vegetation. (<i>Agriculture – land management; Enhance habitat – private lands; Conserve wildlife – invasives</i>)

Priority	Conservation Actions (continued)
2°	Review and improve Landscape Project species habitat models as new research and land use/land cover data become available. (<i>Protect habitat – Landscape Project</i>)
Inventory and monitor endangered, threatened and special concern wildlife and fish	
1°	Conduct the annual Mid-Winter Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct the Atlantic Flyway Breeding Waterfowl Survey. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Identify critical habitats and assess their condition for breeding, migratory, and wintering waterfowl populations. Identify protection strategies (e.g., acquisition, landowner incentives) to maintain existing waterfowl habitat. (<i>Conserve wildlife – game species</i>)
1°	Act to maintain, enhance, and restore habitats, as appropriate, for waterfowl. (<i>Conserve wildlife – game species</i>)
1°	Conduct surveys for all endangered and threatened species and selected species of special concern in the Southern Highlands Zone at regularly scheduled intervals to track population and habitat trend data. (<i>Monitor wildlife – long-term monitoring</i>)
Maintain populations of endangered, threatened and special concern wildlife and fish	
1°	Identify and implement best management practices for cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, scrub/shrub birds and woodland raptors. (<i>Agriculture – land management; Silviculture – land management; Enhance habitat – private lands</i>)
1°	Identify and maintain important winter foraging sites for short-eared owls and northern harriers. Work with private landowners to protect and maintain suitable wintering habitat. Provide incentives through various federal programs. (<i>Silviculture – land management; Agriculture – land management; Protect habitat – migratory birds</i>)
1°	Develop and implement proactive species recovery plans for all endangered and threatened species within this zone. Develop and implement proactive habitat conservation plans aimed at meeting and maintaining recovery goals for these species. (<i>Conserve wildlife – rare wildlife</i>)
1°	Develop and implement management actions to enhance populations of special concern and rare fish. (<i>Protect habitat – fish</i>)
1°	Revise and improve species habitat models used in the Landscape Project based on new land use/land cover data and data on species habitat requirements. (<i>Protect habitat – Landscape Project</i>)
Identify and protect summer bat habitat	
1°	Conduct statewide acoustical sampling to determine distribution, range, and habitat use of summer bats. Long-term acoustical sampling should be conducted to determine population trends and species response to changes in habitats. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Trap Indiana bats during spring emergence from hibernacula and apply colored plastic bands to aid in recovery efforts during summer concentration surveys. (<i>Monitor wildlife – long-term monitoring</i>)

1

Priority	Conservation Actions (continued)
1°	Continue volunteer-based summer bat concentration surveys to locate important maternity sites and determine roost characteristics. Trap and band bats at summer concentration sites to identify bat species; apply colored plastic bands to Indiana bats to aid in recognition during hibernation surveys. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Conduct telemetry studies during spring emergence from hibernacula to determine dispersal distances, roost characteristics, and travel corridors of Indiana bats. (<i>Protect habitat – Landscape Project</i>)
1°	Conduct telemetry studies during summer months to determine roost characteristics and habitat requirements for maternity colonies. (<i>Protect habitat – Landscape Project</i>)
1°	Evaluate and assess impacts of wind turbines to bat populations. (<i>Protect habitat – development</i>)
1°	Develop a GIS model of Indiana bat habitat to incorporate into the Landscape Project. Identify appropriate protection strategies to maintain and enhance habitat (landowner incentives for protecting summer habitat, public education regarding importance of bat conservation, development of best management practices). (<i>Protect habitat – Landscape Project</i>)
1°	Develop Indiana bat recovery plan in accordance with federal guidelines and strategies set forth in the USFWS Indiana Bat Recovery Plan (U.S. Fish and Wildlife Service, 1999). (<i>Protect habitat – Landscape Project</i>)
Identify and protect important hibernacula for wintering bats	
1°	Survey abandoned mines, caves, and railroad tunnels and determine their suitability as winter roost sites. Work with private and public land managers to protect active hibernacula from human disturbance. (<i>Monitor wildlife – long-term monitoring</i>)
1°	Assess need for stabilization and gating of important bat hibernacula to ensure structural soundness and prevent human disturbance. Install data loggers in important hibernacula to monitor internal conditions and evaluate impacts of gating structures. (<i>Protect habitat - humans</i>)
1°	Work with Bureau of Law Enforcement to patrol sites that are vulnerable to human disturbance and vandalism. (<i>Protect habitat - humans</i>)
1°	Identify appropriate protection strategies to maintain and enhance habitat (e.g., working with recreational groups to limit cave and mine access to summer months, landowner incentives for protecting winter habitat). (<i>Protect habitat - humans</i>)
Protect and enhance important and unique habitats	
1°	Identify, protect, and enhance critical migratory stopover habitats such as Bull's Island State Park and the Delaware River Floodplain Forests. (<i>Protect habitat – migratory birds; Corridors – migratory birds</i>)
1°	Work with local governments and NJ DEP'sNHP to protect and enhance the high quality floodplain forest natural community at the Bull's Island State Park and the Delaware River Floodplain Forests. (<i>Protect habitat –development, sprawl; Enhance habitat – development, sprawl</i>)

Priority	Conservation Actions (continued)
Maintain natural biodiversity, community integrity and structure and ecosystem function	
1°	Develop area-specific deer density or percent-reduction targets to reduce herd size to a sustainable level where regeneration of native vegetative communities is possible. (<i>Conserve wildlife - deer</i>)
1°	Where appropriate, continue to develop and expand incentives for harvesting antlerless deer (e.g. “earn-a-buck”). (<i>Conserve wildlife - deer</i>)
1°	Monitor forest regeneration via a system of exclosures and vegetative sample plots throughout critical habitats on state lands to evaluate habitat health in response to changing deer densities. The NJ Division of Fish and Wildlife, Bureau of Wildlife Management will apply these data in making deer management decisions regarding appropriate seasonal harvest limits. (<i>Conserve wildlife - deer</i>)
1°	Reduce the impacts of mute swan herbivory to native vegetation in wetlands and managed impoundments. (<i>Conserve wildlife – invasives</i>)
1°	Work with land management agencies to Identify areas where invasive, non-indigenous plants are either already established or are becoming established through surveys and public participation. Prioritize areas for control projects. (<i>Conserve wildlife – invasives</i>)
1°	Collaborate with public and private landowners to determine the appropriate physical, chemical or biological control measures, or a combination of these, in areas that are identified as providing critical habitat for endangered, threatened, or priority wildlife species and are being threatened by invasive non-indigenous plants. Control measures often cause soil disturbance that increases the chance of invasion by the same or other non-indigenous plants. (<i>Conserve wildlife – invasives</i>)
1°	Establish a Division policy to control damage to native wildlife populations resulting from feral and free-ranging domestic cats on public lands. (<i>Conserve Wildlife – cats, subsidized predators</i>)
1°	Work with land management agencies to survey and monitor the spread of invasive insect species that jeopardize forest health. The species of primary concern include the hemlock woolly adelgid, gypsy moth, and emerald ash borer. Collaborate on the appropriate control options for these pests and use appropriate control methods to reduce tree damage and limit the spread of infestations. (<i>Conserve wildlife – invasives</i>)
Promote public education and viewing opportunities	
1°	Develop education materials about management practices for the public and for private landowners with significant bog turtle, wood turtle, cavity-nester, grassland bird, forest passerine, woodland raptor, scrub-shrub/open field bird populations. (<i>Education – humans</i>)
1°	Develop public education materials regarding the most aggressive, invasive non-indigenous plants to involve them in detecting problem areas early while they are still manageable. Early recognition of the establishment of new populations is key to the successful control. (<i>Education – humans; Conserve wildlife – invasives</i>)

Priority	Conservation Actions (continued)
1°	Preventing establishment of non-indigenous species is the simplest and most cost-effective means of stopping invasions. Encourage native plant use in landscaping through public awareness and landscaping companies as introduced ornamental plants are a major source of non-indigenous species that invade natural plant communities. (<i>Education – humans; Conserve wildlife – invasives</i>)
2°	Educate homeowners on proper eviction of house-dwelling bat populations and importance of providing alternative roosting structures for maternity colonies. (<i>Education – humans</i>)
2°	Develop a field guide to NJ's freshwater mussel species to assist in promoting public education and increase awareness of New Jersey's native freshwater mussel fauna. (<i>Education – humans</i>)
2°	Develop and maintain education materials and viewing opportunities to promote environmental awareness and wildlife conservation. (<i>Education – humans</i>)
2°	Develop public education materials to increase awareness of New Jersey's indigenous nongame fish species. (<i>Education – humans</i>)

f. Potential Partnerships to Deliver Conservation

Private Landowners

- Protect and enhance habitat through innovative partnerships with private landowners.
 - Implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines, freshwater wetland birds, grassland birds, ospreys, raptors, and scrub-shrub/open field birds.
 - Utilize incentive programs that encourage the management of grassland and scrub/shrub communities and the conservation of bog turtles, and to protect water quality and riparian habitat in areas where rare mussels occur.
 - Encourage farmers to preserve farmland through conservation easements through partnerships with Green Acres, the Nature Conservancy, Land Trust, and local municipalities for the conservation of grassland and scrub/shrub communities and bog turtles.
 - Develop and implement landowner incentives for providing, maintaining, and protecting summer and winter bat habitat.
 - Develop/maintain cooperative relationships with private landowners with bog turtles on their land.
 - Work with landowners to inventory their properties for the presence and severity of invasive non-indigenous plant invasions. Work with them to develop effective control or eradication measures to protect critical wildlife habitats.

Public

- Expand volunteer Citizen Scientist recruitment and activities.
 - Collaborate with conservation groups such as NJ Audubon Society, D&R Greenway, local land trusts, The Nature Conservancy – NJ Chapter (TNC), NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to locate, survey, and monitor wildlife habitats and populations in a systematic manner to achieve short and long term monitoring goals.

- Collaborate with NJ Audubon Society, NJ Conservation Foundation, and other environmental, member-based organizations to recruit and train Citizen Scientists to monitor vegetative plots (exclosures) on state lands for evaluation of vegetative structure in response to deer densities.
- Recruit North American Butterfly Association volunteers to conduct surveys for butterfly and moth species
- Involve Citizen Scientists in conservation projects, such as stream bank restoration.
- Continue volunteer-based summer bat concentration surveys.

Wildlife Professionals

- Collaborate with researchers in New York, Pennsylvania, and West Virginia to develop best management practices and conservation plans for scrub-shrub/open field birds.
- Collaborate with the National Native Mussel Conservation Committee and other experts to develop best management practices for areas with listed and special concern species.
- Work with American Museum of Natural History to maintain existing NY/NJ freshwater mussel web site.
- Consult with animal control officers and extermination companies to implement proper removal of bats from houses and educate them on the importance of providing alternative roosting structures.

Conservation Organizations

- Partner with NJ Audubon Society, The Nature Conservancy – NJ Chapter, NJ Conservation Foundation, and conservation organizations to maintain and enhance habitats.
 - Protect cavity-nester and woodland raptor nesting and foraging sites.
 - Protect and enhance riparian habitats.
 - Initiate and support eradication efforts for invasive plant species.
- Consult with conservation organizations to develop educational programs.
- Encourage the use of Landscape Project's critical habitat mapping to guide land acquisition by conservation organizations through programs such as Green Acres, State Agricultural Development Committee (SADC) Farmland Preservation, and local land trusts.
- Continue participation in regional and national bat conservation efforts such as the Northeast Bat Working Group and the North American Bat Conservation Partnership.
- Conduct habitat surveys to determine geographic distribution and severity of non-indigenous plant invasions.

Local Government, Other State and Federal Agencies

- Partner with local, state, and federal government agencies including municipal and county planning boards, NRCS, USFWS - NJ Field Office, and USDA, and the DCA, Office of Smart Growth to protect, enhance, and create habitats and to protect NJ's native wildlife.
 - NJ Department of Environmental Protection's (DEP) Division of Fish and Wildlife (DFW) to protect osprey, cavity-nester, and woodland raptor nesting and foraging sites.
 - DFW to develop a plan to protect sensitive bog turtle and wood turtle sites from disturbance.
 - DFW to share site information and expertise with state and federal law enforcement to increase surveillance of bog turtle and wood turtle sites.

- DFW and conservation organizations to work with the DEP's Land Use Regulation Program to protect and appropriately classify wetlands for special concern reptile and amphibian populations.
- Expand efforts to create habitat and implement best management practices that protect nesting and foraging sites of cavity-nesters, forest passerines and raptors, and other forest-dwelling species on state lands and with natural resource managers, county and municipal utility authorities and planners; and where grassland/scrub-shrub habitats already exist, enhance and maintain habitats for grassland and scrub-shrub/open field birds.
- DFW to work with land managers to maintain grassland bird habitats by impeding succession with controlled burns and scheduled mowing.
- DFW to encourage greater buffers for important riparian and floodplain areas for forest passerines, reptiles, amphibians, freshwater mussels, and invertebrates with DEP's Division of Watershed Management and Land Use Regulation Program. Partner with them to investigate water quality and threats of contaminants/pollution and to make recommendations on stream encroachment permit issues for areas with listed mussels and rare fish species.
- DFW to develop specific conservation plans for special concern reptiles and amphibians on state lands.
- DFW to work with state and county mosquito commissions to prevent the use of insecticides and biological controls at known amphibian breeding sites.
- DFW will integrate results of vegetative structure in response to deer densities into deer management strategies within deer management zones.
- DFW to work with land management agencies at the state, local, and federal levels to implement deer management plans and harvest quotas that achieve desired deer densities to maintain ecological integrity of natural communities.
- DFW to work with the USFWS, Department of Defense, and National Park Service to develop effective plans to eradicate invasive non-indigenous plants on federal and state lands and in aquatic systems that are threatening critical wildlife habitats.
- DFW to work with USDA through NRCS and the WHIP program to control purple loosestrife and other invasive plants in critical wildlife habitats.
- DFW to work with the DEP's Office of Natural Lands Management, Natural Heritage Program to develop mapping of significant vegetative communities to be incorporated as a layer within the Landscape Map. Sensitive information would be a separate layer for use within the NJ Department of Environmental Protection only.
- DFW to determine groundwater recharge areas for bog turtle habitats and vernal pools with the DEP's Division of Water Quality (DWQ) and the NJ Geological Survey. Expand efforts with DWQ to minimize impacts on water quality and conduct hydrological monitoring in these areas.
- DFW to work with neighboring state fish and wildlife agencies to radio-track dispersing Indiana bats across state boundaries.
- DFW to work with USFWS and other state and federal partners to implement North American Waterfowl Management Plan as appropriate.
- DFW to work with USFWS and other state and federal partners to implement American Woodcock Management Plan as appropriate.

- DFW and DEP's Water Monitoring and Standards to work together to recommend classification upgrades in water bodies where listed or special concern species occur.
- DFW to partner with local, county, and state authorities to establish best management practices in areas where listed or special concern fish, freshwater mussels, and wildlife species occur.
- DFW to work with the LURP to make recommendations on stream encroachment permit issues for areas where listed or special concern species occur.
- DFW to work with the State Planning Commission, the Office of Smart Growth and local governments to protect critical wildlife habitat and unique communities through the designation of Special Resource Areas within the State Development and Redevelopment Plan.
- DFW to work with the newly created Highlands Council to implement the Landscape Project within the Highlands Region. Work with the Council to designate "no build zones" in the preservation area that are identified as critical habitat on the Landscape maps. Help to identify conservation areas in the surrounding planning area based on Landscape maps.
- DFW to lead in the development of educational materials for the public and private landowners about wildlife of greatest conservation need and associated habitats.
- DFW, conservation organizations, and park commissions to expand public outreach through wildlife viewing opportunities.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide habitat protection and land acquisition by federal, state, and local governments through programs such as DEP's Green Acres Program, State Agricultural Development Committee (SADC), Farmland Preservation, local land trusts, and through mitigation.
- DEP to encourage the use of the Landscape Project's critical habitat mapping to guide land use planning and zoning decisions by planning agencies at the federal, state, and local level.

g. Monitoring Success

- Conduct habitat assessment and monitor habitat changes over time; monitor efficacy of habitat management and restoration efforts.
- Annually monitor abundance, productivity, distribution, and trends of osprey (biannually), bog turtles, wood turtles, forest-dwelling bats, cavity-nesters, colonial waterbirds, forest passerines (2-4 years), freshwater wetland birds (2-4 years), and grassland bird, raptor, and scrub-shrub/open field bird communities (2-4 years), particularly in areas beyond the reach of the Breeding Bird Survey.
- Sponsor "Hawk Watches" for raptor monitoring during the fall migration.
- Continue the long-term monitoring of reptile and amphibian populations through the Herp Atlas Project, the Calling Amphibian Monitoring Program, and the Vernal Pool Project.
- Work with volunteers, private landowners and conservation groups to monitor the success of eradication/control projects that target invasive non-indigenous plants.
- Continue to monitor deer densities and deer harvest data.
- Monitor populations of breeding, migratory and wintering waterfowl of conservation concern.
- Develop indicator metrics for monitoring forest health and implement at the scale necessary to monitor effectiveness of deer management strategies.

1 **III. Appendices**

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A. Appendix I: New Jersey's Most Vulnerable Wildlife

1. Definitions of Status

Table W1. Status of Wildlife in New Jersey

Endangered: A species whose prospects for survival in New Jersey are in immediate danger because of a loss or degradation of habitat, over-exploitation, predation, competition, disease, disturbance, or contamination. An endangered species requires immediate action to avoid extinction in New Jersey.
Threatened: A species that may become endangered if conditions surrounding it begin to, or continue to, deteriorate. Thus, a threatened species is one that is already vulnerable as a result of small population size, restricted range, narrow habitat affinities, or significant population decline.
Special Concern: A species that warrants special attention because continued (or further) habitat degradation or modification would result in their becoming threatened. This category also applies to species that meet these criteria and for which there is little understanding of their status in the state. The term, for the purpose of the Comprehensive Wildlife Conservation Strategy, also includes species identified as regional concern in national and regional conservation plans such as Partners in Flight Bird Conservation Plans, North American Waterbird Conservation Plan (Mid-Atlantic/ New England/ Maritimes), USFWS species of conservation concern (2002), North American Waterfowl Management Plan, and the United States Shorebird Conservation Plan.
Secure/Stable: A species that appears to be secure in the state and not in danger of falling into any of the preceding three categories in the near future.
Unknown: A species for which it is impossible to assign any of the preceding statuses because enough information on which to base a judgment simply does not exist.
Extirpated: Applies to a species previously known to occur in the state for which there is substantial evidence that no extant populations currently exist.

Table W2. State and global element ranks as defined by NatureServe Conservation Status Assessment - (For more information, visit NatureServe Conservation Status Assessment web site: <http://www.natureserve.org/explorer/>)

S1: Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Species ranked S1 are often restricted to specialized habitats and/ or restricted to an extremely small (3%) geographical area of the state. Also included are species which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are species for which even with intensive searching, sizable additional occurrences are unlikely to be discovered.
S2: Imperiled in New Jersey because of rarity (6 to 20 occurrences or few remaining individuals or acres). Historically many of these species may have been more frequent, but now, largely through habitat destruction, are known from fewer extant occurrences. The S2 rank also includes species which occur in habitats restricted to 10 % of the total state area.

1 (Appendix I continued)

S3: Rare in state with 21-100 occurrences. Includes species which are widely distributed in the state but often occurring in small populations, and also in habitats which may be common or widespread. Species having a moderately restricted distribution (but greater than 10%) in New Jersey but are locally abundant, are also included. Species ranked S3 are not yet imperiled in state but may soon be if additional populations are destroyed.
S4: Apparently secure in state, with many occurrences.
S5: Demonstrably secure in state and essentially ineradicable under present conditions.
SA: Accidental in state, including species (usually birds or butterflies) recorded once or twice or only at very great intervals, hundreds or even thousands of miles outside their usual range; a few of these species may even have bred on the one or two occasions they were recorded; examples include European strays or western birds on the East Coast and vice-versa.
SH: Elements of historical occurrence in New Jersey. Despite some searching of historical occurrences and/ or potential habitat, no extant occurrences are known. Since not all of the historic occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work.
SU: Elements believed to be in peril but the degree of rarity uncertain. Also included are rare taxa of uncertain taxonomical standing. More information is needed to resolve rank.
SZ: Not of practical conservation concern in New Jersey, because there are no definable occurrences although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long distance migrants whose occurrences during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. In other words, the migrant regularly passes through the state, but enduring, mappable element occurrences cannot be defined. Typically, the SZ rank applies to a non-breeding population (N) in the state – for example, birds on migration. An SZ rank may in a few instances also apply to a breeding population (B), for example certain lepidoptera which regularly die out every year with no significant return migration.
Although the SZ rank typically applies to migrants, it should not be used indiscriminately. Just because a species is on migration does not mean it receives an SZ rank. SZ will only apply when the migrations occur in an irregular, transitory and dispersed manner.
G1: Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2: Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3: Either very rare and local throughout its range or found locally (even abundantly at some of the locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21-100.
G4: Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.

1 (Appendix I continued)

G5: Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.
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B: Refers to the breeding population of the element in the state.
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N: Refers to the non-breeding population of the element in the state.
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Q: Element containing a “Q” in the global portion of its rank indicates that the taxon is of questionable, or uncertain taxonomical standing, e.g., some authors regard it as a full species, while others treat it at the subspecific level.
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(Appendix I continued)

2. Wildlife of Greatest Conservation Need, their Location in New Jersey, and the Management Strategy

Table W3. Federal Endangered and Threatened Species*

Common Name	Scientific Name	Federal Status & Regional Priority	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Mammals								
Blue whale	<i>Balaneoptera musculus</i>	E	SA, G3G4	I				
Fin whale	<i>Balaneoptera physalus</i>	E	SZN, G3G4	I				
Humpback whale	<i>Megaptera novaeangliae</i>	E	SZN, G3	I				
Indiana bat	<i>Myotis sodalis</i>	E	S1, G2	R	R	R	R	I
North Atlantic Right whale	<i>Balaena glacialis</i>	E	-	I				
Sei whale	<i>Balaneoptera borealis</i>	E	G3	I				
Sperm whale	<i>Physeter macrocephalus</i>	E	SA, G3G4	I				
Birds								
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	S1B, S2N, G4	M	I	I	I	I
Piping plover	<i>Charadrius melodus</i>	T & RP	S1B, G3	I				
Roseate tern	<i>Sterna dougallii</i>	E/T & RP	SHB, G4	R				
Reptiles								
Bog turtle	<i>Glyptemys mühlenbergii</i>	T	S2, G3	R	R	I	I	I
Green sea turtle	<i>Chelonia mydas</i>	E/T	SZN, G3	I	I			
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	E	SZN, G3	I	I			
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	E	SZN, G1	I	I			
Leatherback sea turtle	<i>Dermochelys coriacea</i>	E	SZN, G3	I	I			
Loggerhead sea turtle	<i>Caretta caretta</i>	T	SZN, G3	I	I			
Mollusks								
Dwarf wedgemussel	<i>Alasmidonta heterodon</i>	E & RP	S1, G1G2			I		I
Insects								
American burying beetle**	<i>Nicrophorus mericanus</i>	E	SH, G2G3			R		R
Mitchell's satyr**	<i>Neonympha m. mitchellii</i>	E	SH, G1G2					R
Northeastern beach tiger beetle	<i>Cincindela d. dorsalis</i>	T	S1, G4	I				
Fish								
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	E & RP	S3, G3		M	R		

* All Federal Endangered and Threatened species have an Endangered status on the NJ List of Endangered Wildlife.

** Only historic records exist, species believed to be extirpated.

T: Federally threatened species.

E: Federally endangered species.

E/T: Federally endangered species during breeding season, federally threatened species during non-breeding season.

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

(Appendix I continued)

Table W4. State Endangered Species

Common Name	Scientific Name	Regional Priority	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Mammals								
Allegheny woodrat	<i>Neotoma floridana magister</i>		S1, G3G4			I		R
Bobcat	<i>Lynx rufus</i>		S3, G5		R	I	R	I
Birds								
American bittern	<i>Botaurus lentiginosus</i>	RP	S2B, G4	R	R	I	I	I
Black skimmer	<i>Rynchops niger</i>	RP	S1B, G5	I	R	I	M	
Henslow's sparrow	<i>Ammodramus henslowii</i>	RP	S1B, G4		I			
Least tern	<i>Sterna antillarum</i>	RP	S1B, G4	I	I	I	M	
Loggerhead shrike	<i>Lanius ludovicianus</i>	RP	S1B, S1N, G5 (migrant only)		R	R		
Northern goshawk	<i>Accipiter gentilis</i>		S1B, S4N, G5					I
Northern harrier	<i>Circus cyaneus</i>		S1B, S3N, G5	I	I	I		I
Peregrine falcon	<i>Falco peregrinus</i>		S1B, G4	M	M	I		R
Pied-billed grebe	<i>Podilymbus podiceps</i>	RP	S1B, S3N, G5	I	R	I		I
Red-shouldered hawk	<i>Buteo lineatus</i>		S1B, S2N, G5		I	I	I	I
Sedge wren	<i>Cistothorus plantensis</i>	RP	S1B, G5	M	I	I		I
Short-eared owl	<i>Asio flammeus</i>	RP	SHB, S3N, G5	I	I	I		I
Upland sandpiper	<i>Batramia longicauda</i>	RP	S1B, G5			I	I	I
Vesper sparrow	<i>Poocetes gramineus</i>		S1B, S2N, G5		I	I	I	I
Reptiles								
Corn snake	<i>Elaphe g. guttata</i>		S1, G5		I		I	
Timber rattlesnake	<i>Crotalus h. horridus</i>		S2, G4		R		I	I
Queen snake*	<i>Regina septemvittata</i>		SU, G5			R		
Amphibians								
Blue-spotted salamander	<i>Ambystoma laterale</i>		S1, G5					I
Cope's gray treefrog	<i>Hyla chrysocelis</i>		S2, G5	M	I		I	
Eastern tiger salamander	<i>Ambystoma tigrinum</i>		S2, G5		I	R		
Mollusks								
Brook floater	<i>Alasmidonta varicosa</i>	RP	S1, G3					I
Green floater	<i>Lasmigona subviridis</i>	RP	S1, G3					R
Insects								
Appalachian grizzled skipper*	<i>Pyrgus wyandot</i>		SH, G2			R		R
Arogos skipper	<i>Atrytone arogos arogos</i>		S1, G3G4				I	I
Bronze copper	<i>Lycaena hylus</i>		S2, G5		I	I		

* Only historic records exist, species believed to be extirpated.

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

(Appendix I continued)

Table W5. State Threatened Species

Common Name	Scientific Name	Regional Priority	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Birds								
Barred owl	<i>Strix varia</i>		S3B, G5		I	I	I	I
Black rail	<i>Laterallus jamaicensis</i>	RP	S2B, G4	I	I			
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	RP	S3B, S4N, G5	I	I	I	I	I
Bobolink	<i>Dolichonyx oryzivorus</i>	RP	S2B, G5		I	I	I	I
Cooper's hawk	<i>Accipiter cooperii</i>	RP	S3B, S4N, G5		I	I	I	M
Grasshopper sparrow	<i>Ammodramus savannarum</i>	RP	S2B, G5		I	I	M	I
Long-eared owl	<i>Asio otus</i>		S2B, S2N, G5		I	I		I
Osprey	<i>Pandion haliaetus</i>		S2B, G5	M	I	I	M	I
Red knot	<i>Calidris canutus</i>	RP	S3N, G5	I	I			
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	RP	S2B, S2N, G5		I	I	I	I
Savannah sparrow	<i>Passerculus sandwichensis</i>		S2B, S4N, G5		I	I	M	I
Yellow-crowned night-heron	<i>Nyctanassa violaceus</i>	RP	S2B, G5	I	R	I	M	
Reptiles								
Northern pine snake	<i>Pituophis m. melanoleucus</i>		S3, G4		I	I	I	
Wood turtle	<i>Clemmys insculpta</i>		S3, G4			I	I	I
Amphibians								
Eastern mud salamander	<i>Pseudotriton montanus</i>		S1, G5			R	R	
Long-tailed salamander	<i>Eurycea longicauda</i>		S2, G5			R		I
Pine Barrens treefrog	<i>Hyla anderssonii</i>		S3, G4		I	I	I	
Mollusks								
Eastern lampmussel	<i>Lampsilis radiata</i>		S3, G5					I
Eastern pondmussel	<i>Ligumia nasuta</i>		S1, G4G5			I		
Tidewater mucket	<i>Leptodea ochracea</i>	RP	S1, G4			R		R
Triangle floater	<i>Alasmidonta undulata</i>		S3, G4			I		I
Yellow lampmussel	<i>Lampsilis cariosa</i>	RP	S1, G3G4			M		M
Insects								
Checkered white	<i>Pontia protodice</i>		S1, G4			I		
Frosted elfin	<i>Callophrys irus</i>		S2S3, G3		I	I	I	
Silver-bordered fritillary	<i>Bolaria selene myrina</i>		S2, G5			I	I	I

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

1 (Appendix I continued)

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3 Table W6. Nongame Species of Conservation Concern

4 Note: Recovery goals based upon regional plans.

Common Name	Scientific Name	Conservation Status	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Mammals								
Eastern red bat	<i>Lasiurus borealis</i>	RP		R	R	R	R	R
Eastern small-footed myotis	<i>Myotis leibii</i>		S1, G3		R	R	R	R
Hoary bat	<i>Lasiurus cinereus</i>	RP		R	R	R	R	R
Long-tailed (Rock) shrew	<i>Sorex dispar</i>	RP	S1, G4					R
Marsh rice rat	<i>Oryzomys palustris</i>		S3, G5	R	R	R	R	
Silver-haired bat	<i>Lasionycteris noctivagans</i>	RP		R	R	R	R	R
Southern bog lemming	<i>Synaptomys cooperi</i>	RP	S2, G5	R	R	R	R	R
Birds								
Acadian flycatcher	<i>Empidonax virescens</i>	RP	-		M	M	M	I
American golden-plover	<i>Pluvialis dominica</i>	RP	-	M	M	M		I
American kestrel	<i>Falco sparverius</i>	SC	S3B, G5		I	I	I	I
American oystercatcher	<i>Haematopus palliatus</i>	RP	-	I	M	I		
Audubon's shearwater	<i>Puffinus lherminieri</i>	RP	-	M				
Baltimore oriole	<i>Icterus galbula</i>	RP	-		I	I	I	I
Black tern	<i>Chlidonias niger</i>	SC/ RP	SZN, G4	M	I	I		
Black-and-white warbler	<i>Mniotilta varia</i>	RP	-		I	I	I	I
Black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	RP	-		I	I	I	I
Blackburnian warbler	<i>Dendroica fusca</i>	RP	-		M	I		M
Black-throated blue warbler	<i>Dendroica caerulescens</i>	RP	G5			M		M
Black-throated green warbler	<i>Dendroica virens</i>	SC	S3B, G5		I	I	I	I
Blue-headed vireo (solitary vireo)	<i>Vireo solitarius</i>	SC	S3B, G5			I		I
Blue-winged warbler	<i>Vermivora pinus</i>	RP	-		I	I	I	M
Bridled tern	<i>Sterna anaethetus</i>	RP	-	M				
Broad-winged hawk	<i>Buteo platypterus</i>	SC/ RP	S3B, G5		M	M	M	M
Brown thrasher	<i>Toxostoma rufum</i>	RP	-		I	I	M	I
Canada warbler	<i>Wilsonia canadensis</i>	SC/ RP	S3B, G5		M	M		I
Caspian tern	<i>Sterna caspia</i>	SC	SPB, G5	M				
Cattle egret	<i>Bubulcus ibis</i>	RP	-	I	M	M	M	
Cerulean warbler	<i>Dendroica cerulea</i>	SC/ RP	S3B, G4			I	M	I
Chimney swift	<i>Chaetura pelagica</i>	RP	-	I	I	I		I
Chuck-will's-widow	<i>Caprimulgus carolinensis</i>	RP	-		I	R	I	
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	SC	S2B, G5			M		M
Common barn owl	<i>Tyto alba</i>	SC	S3B, G5	M	I	I	I	M
Common nighthawk	<i>Chordeiles minor</i>	SC	S3B, G5		I	M	M	I
Common tern	<i>Sterna hirundo</i>	SC/ RP	S3B, G5	I	I	M		
Dickcissel	<i>Spiza americana</i>	RP	S1B, S4N, G5		M	M	M	

1 (Appendix I continued)

Common Name	Scientific Name	Conservation Status	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Birds (continued)								
Eastern kingbird	<i>Tyrannus tyrannus</i>	RP	-		I	I	M	I
Eastern meadowlark	<i>Sturnella magna</i>	SC/ RP	S3B, S4N, G5		I	I	M	I
Eastern screech-owl	<i>Otus asio</i>	RP	-		M	I	M	M
Eastern towhee	<i>Pipilo erythrophthalmus</i>	RP	-		I	I	I	I
Eastern wood-pewee	<i>Contopus virens</i>	RP	-		I	I	I	I
Field sparrow	<i>Spizella pusilla</i>	RP	-		I	I	I	I
Forster's tern	<i>Sterna forsteri</i>	RP	-	M	M	M		
Glossy ibis	<i>Plegadis falcinellus</i>	RP	S3B, S4N, G5	I	I	M		
Golden-winged warbler	<i>Vermivora chrysoptera</i>	SC/RP	S3B, G4			I		I
Gray catbird	<i>Dumetella carolinensis</i>	RP	-		M	M	M	M
Gray-cheeked thrush	<i>Catharus minimus</i>	SC	-			M		M
Great blue heron	<i>Ardea herodias</i>	SC/ RP	S2B, S4N, G5	M	M	M	M	M
Great crested flycatcher	<i>Myiarchus crinitus</i>	RP	-	I	I	I	I	M
Great egret	<i>Ardea alba</i>	RP	-	M	M	M	M	
Greater shearwater	<i>Puffinus gravis</i>	RP	-	M	M	M		
Greater yellowlegs	<i>Tringa melanoleuca</i>	RP	-	M				
Green heron	<i>Butorides virescens</i>	RP	-	M	M	I	M	M
Gull-billed tern	<i>Sterna nilotica</i>	RP	S1B, G5	M				
Hooded warbler	<i>Wilsonia citrina</i>	RP	S3B, G5		M	M	M	M
Horned grebe	<i>Podiceps auritus</i>	RP	G5	M	M	M		
Horned lark	<i>Eremophila alpestris</i>	SC	S3B, S4N, G5	M	I	M	M	M
Hudsonian godwit	<i>Limosa haemastica</i>	RP	-	M				
Indigo bunting	<i>Passerina cyanea</i>	RP	-		I	I	M	I
Kentucky warbler	<i>Oporornis formosus</i>	SC/ RP	S3B, G5		I	I	I	I
King rail	<i>Rallus elegans</i>	SC/ RP	S3B, G4G5	M	M	M	M	M
Least bittern	<i>Ixobrychus exilis</i>	SC/ RP	S3B, G5	M	M	M		M
Least flycatcher	<i>Empidonax minimus</i>	SC/ RP	S3B, G5			I	I	I
Little blue heron	<i>Egretta caerulea</i>	SC/ RP	S2B, G5	I	M	I	M	
Louisiana waterthrush	<i>Seiurus motacilla</i>	RP	-		M	M	M	I
Manx shearwater	<i>Puffinus puffinus</i>	RP	-	M				
Marbled godwit	<i>Limosa fedoa</i>	RP	-	M				
Marsh wren	<i>Cistothorus palustris</i>	RP	S4B, S4N, G5	M	M	I	M	M
Nelson's sharp-tailed sparrow	<i>Ammodramus nelsoni</i>	RP	-	M				
Northern flicker	<i>Colaptes auratus</i>	RP	-		I	I	I	I
Northern gannet	<i>Morus bassanus</i>	RP	-	M	M	M		
Northern parula	<i>Parula Americana</i>	SC	S3B, G5		M	M	M	M
Pine warbler	<i>Dendroica pinus</i>	RP	-		M	M	M	M
Prairie warbler	<i>Dendroica discolor</i>	RP	-		I	I	I	I
Prothonotary warbler	<i>Protonotaria citrea</i>	RP	-		I	I	I	
Purple finch	<i>Carpodacus purpureus</i>	RP	S3B, S4N, G5			R		I

1 (Appendix I continued)

Common Name	Scientific Name	Conservation Status	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Birds (continued)								
Purple sandpiper	<i>Calidris maritima</i>	RP	-	M				
Razorbill	<i>Alca torda</i>		-	M	M	M		
Red-throated loon	<i>Gavia stellata</i>	RP	-	M	M	M		
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	RP	-		I	I	I	I
Royal tern	<i>Sterna maxima</i>	RP	S1B, G5	I				
Ruddy turnstone	<i>Arenaria interpres</i>	RP	-	M	I			
Saltmarsh sharp-tailed sparrow	<i>Ammodramus caudacutus</i>	RP	-	I	I	R	M	
Sanderling	<i>Calidris alba</i>	SC/ RP	-	M	I			
Scarlet tanager	<i>Piranga olivacea</i>	RP	-		I	I	I	M
Seaside sparrow	<i>Ammodramus maritimus</i>	RP	-	M	M	R	M	
Semipalmated sandpiper	<i>Calidris pusilla</i>	RP	-	I	I			
Sharp-shinned hawk	<i>Accipiter striatus</i>	SC/ RP	S2B, S3N, G5		M	M		M
Snowy egret	<i>Egretta thula</i>	SC/ RP	S3B, S4N, G5	I	I	I	M	
Spotted sandpiper	<i>Actitis macularia</i>	SC	S3B, G5		M	M	M	M
Summer tanager	<i>Piranga rubra</i>	RP	-			M		
Swainson's warbler	<i>Limothlypis swainsonii</i>	RP	-		M			
Tricolored heron	<i>Egretta tricolor</i>	SC/ RP	S3B, G5	I	I			
Veery	<i>Catharus fuscescens</i>	SC	S3B, G5		I	I	I	I
Whimbrel	<i>Numenius phaeopus</i>	SC/ RP	S3N, G5	M				
Whip-poor-will	<i>Caprimulgus vociferus</i>	RP	S4B, G5		I	I	I	I
Willet	<i>Catoptrophorus semipalmatus</i>	RP	-	M	M	M		
Willow flycatcher	<i>Empidonax traillii</i>	RP	-		I	I		I
Wilson's phalarope	<i>Phalaropus tricolor</i>	RP	-	M				
Winter wren	<i>Troglodytes troglodytes</i>	SC	S3B, S4N, G5			M		M
Wood thrush	<i>Hylocichla mustelina</i>	RP	-		I	I	I	I
Worm-eating warbler	<i>Helmitheros vermivorus</i>	RP	S3B, G5		M	M	M	I
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	RP	-					M
Yellow-billed cuckoo	<i>Coccyzus americanus</i>	RP	-		I	I	I	I
Yellow-breasted chat	<i>Icteria virens</i>	SC/ RP	S3B, G5		I	I	M	I
Yellow-throated vireo	<i>Vireo flavifrons</i>	RP	-		I	I	I	M
Yellow-throated warbler	<i>Dendroica dominica</i>	RP	-		M	M	M	M
Reptiles								
Coastal plain milk snake	<i>Lampropeltis triangulum triangulum</i> x <i>L. t. elapsoides</i>	SC	-			M	M	
Eastern box turtle	<i>Terrapene carolina carolina</i>	SC	-	M	M	M	M	M
Eastern kingsnake	<i>Lampropeltis getula getula</i>	SC	S4, G5		M	M	M	

1 (Appendix I continued)

Common Name	Scientific Name	Conservation Status	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Reptiles (continued)								
Northern copperhead	<i>Agkistrodon contortrix mokasen</i>	SC	S4, G5			M		M
Northern diamondback terrapin	<i>Malaclemys terrapin terrapin</i>	SC	SU, G4	I	I	I	M	
Spotted turtle	<i>Clemmys guttata</i>	SC	-		M	M	M	M
Amphibians								
Carpenter frog	<i>Rana virgatipes</i>	SC	-		M	M	M	M
Fowler's toad	<i>Bufo woodhousii fowleri</i>	SC	-	M	M	M	M	M
Jefferson salamander	<i>Ambystoma jeffersonianum</i>	SC	S3, G5			M		M
Marbled salamander	<i>Ambystoma opacum</i>	SC	S3, G5		M		M	M
Northern spring salamander	<i>Gyrinophilus porphyriticus porphyriticus</i>	SC	S3, G5			M		M
Mollusks								
Creeper	<i>Strophitus undulates</i>	SC	-			M		M
Insects								
	<i>Catocala jair ssp 2</i>		S3, G4				EX	
	<i>Eusarca fundaria</i>		S2S3, G4		EX			
	<i>Lytrosis sinuosa</i>		S3, G4		EX			
	<i>Nemoria saturiba</i>		S1?, G4?					
	<i>Pero zalissaria</i>		S2S4, G4		X			
	<i>Richia sp 2</i>		S1, G1Q				EX	
	<i>Simyra sp 1</i>		S1?, G4Q		EX			
	<i>Zanclognatha sp 1</i>		S3, G3G4		X		EX	
A geometrid moth	<i>Idaea violacearia</i>		S1S3, G4		X		X	
A geometrid moth	<i>Metarranthis lateritaria</i>		S1, G2G4				X	
A geometrid moth	<i>Metarranthis sp 1</i>		S2, G3		X		X	
A noctuid moth	<i>Apamea inebriata</i>		S2S4, G4		X			
A noctuid moth	<i>Apamea mixta</i>		S2S4, G3G4					
A noctuid moth	<i>Apharetra dentata</i>		S2S3, G4				X	
A noctuid moth	<i>Chytonix sensilis</i>		S1S3, G4			X	X	
A noctuid moth	<i>Cucullia alfarata</i>		S2?, G4		EX		X	
A notodontid moth	<i>Heterocampa varia</i>		S3, G3G4			X		
A noctuid moth	<i>Macrochilo louisiana</i>		S2S3, G4			X	X	
A noctuid moth	<i>Macrochilo santerivalis</i>		S1S3, G3G4		X	X		
A noctuid moth	<i>Macrochilo sp 1</i>		S3, G3		X	X	X	
A noctuid moth	<i>Meropleon cosmion</i>		S1S2, G4		X		X	
A noctuid moth	<i>Meropleon titan</i>		S1, G2G4		X			
A slugmoth	<i>Monoleuca semifascia</i>		S2S3, G4G5			X	X	
A spanworm	<i>Itame sp 1</i>		S3, G3			X	X	

1 (Appendix I continued)

Common Name	Scientific Name	Conservation Status	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Insects (continued)								
Buchholz's gray	<i>Hypomecis buchholzaria</i>		S3, G3G4				X	
Carter's noctuid moth	<i>Spartiniphaga carterae</i>		S2, G2G3				X	
Chain fern borer moth	<i>Papaipema stenocelis</i>		S3, G4		X		X	
Clubtail dragonfly	<i>Gomphus septima</i>		S1, G2			X		X
Daecke's pyralid moth	<i>Crambus daeckellus</i>		S1S3, G1G3				X	
Doll's merolonche	<i>Merolonche dolli</i>		S1S3, G3G4			EX	X	
Dotted skipper	<i>Hesperia attalus</i>	SC	S2S3, G3G4		M		M	
Extra-striped snaketail	<i>Ophiogomphus anomalus</i>		SH, G3					X
Granitosa fern moth	<i>Callopietria granitosa</i>		S2S3, G4G5				X	
Green-faced clubtail	<i>Gomphus viridifrons</i>		S1, G3					
Half yellow moth	<i>Tarachidia semiflava</i>		S2S4, G4		X			
Harris's checkerspot	<i>Chlosyne harrisii</i>	SC	S2S3, G4			M		M
Herodias or Gerhard's underwing	<i>Catocala herodias gerhardi</i>		S3, G3				X	
Hessel's hairstreak	<i>Callophrys hesseli</i>	SC	S3S4, G3G4		M		M	
Lemmer's pinion moth	<i>Lithophane lemmeri</i>		S2, G3G4		X	X	X	
Maritime sunflower borer	<i>Papaipema maritima</i>		S1, G3	X	X			
New England bluet	<i>Enallagma laterale</i>		S1S2, G3					X
Northern metalmark	<i>Calephelis borealis</i>	SC	S2S3, G3G4					M
Pine Barrens bluet	<i>Enallagma recurvatum</i>		S3, G3		X		X	
Pine Barrens zale	<i>Zale sp 1</i>		S3, G3Q				EX	
Pink streak	<i>Faronta rubripennis</i>		S3, G3G4		X	X	X	
Pitcher plant borer moth	<i>Papaipema appassionate</i>		S2S3, G4				X	X
Placentia tiger moth	<i>Grammia placentia</i>		S1S3, G4				X	
Precious underwing	<i>Catocala pretiosa pretiosa</i>		S2S3, G4		X		EX	
Rare skipper	<i>Problema bulenta</i>		S2, G2G3		X	X	X	
Regal moth	<i>Citheronia regalis</i>		S3, G5		X			
Ringed boghaunter	<i>Williamsonia lintneri</i>		SH, G3			X		
Rippled wave	<i>Idaea obfusaria</i>		S2S4, G4G5		X			
Scarlet bluet	<i>Enallagma pictum</i>		S3, G3		X	X	X	
Schweitzer's buckmoth	<i>Hemileuca sp 2</i>		S1, G1Q					X
Southern ptichodis	<i>Ptichodis bistrigata</i>		S1S3, G3				X	
The consort, or consors underwing	<i>Catocala consors consors</i>		S1S3, G4		EX	X***	EX	
Two-spotted skipper	<i>Euphyes bimacula</i>	SC	S3, G4				M	

1 (Appendix I continued)

Common Name	Scientific Name	Conservation Status	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Fish								
American brook lamprey*	<i>Lampetra appendix</i>	RP	S2, G4			X	X	X
Atlantic sturgeon	<i>Acipenser oxyrhynchus</i>	SC** & RP	S3, G3	X	X	X		
Banded sunfish*	<i>Enneacanthus obesus</i>	RP	-				X	
Black-banded sunfish	<i>Enneacanthus chatedon</i>	RP	-				X	
Bridle shiner	<i>Notropis bifrenatus</i>	RP	-			X		X

2 *Species is also recognized as target species of ecoregional concern by the Nature Conservancy - NJ Chapter

3 **Federal species of special concern. Note: Atlantic sturgeon is a game species, currently with a national moratorium on any take.

4 *** Only historic records exist, species believed to be extirpated.

5 SC: NJ state species of special concern.

6 RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

7 M: Maintain population, species occurs within specific habitat(s) of landscape region.

8 I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

9 R: Research and restore population, suitable habitat, species presence unknown.

10 X: Species present. Management strategy not yet determined.

11 EX: Extant population. Observations are extremely rare, but populations still exist in the state.

12
13 **Table W7. Game Species of Regional Priority**

14 Note: Species identified within the table have seasonal harvests within New Jersey.

Common Name	Scientific Name	Regional Priority	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Birds								
American black duck	<i>Anas rubripes</i>	RP	-	M	M	I	I	I
American woodcock	<i>Scolopax minor</i>	RP	-		I	I	I	I
Atlantic brant	<i>Branta bernicla</i>	RP	-	M		M		
Black scoter	<i>Melanitta nigra</i>	RP	-	R	R	R		
Bufflehead	<i>Bucephala albeola</i>	RP	-	M	M	M		
Canada geese (Atlantic population, migrants)	<i>Branta canadensis interior</i>	RP	-	M	M	M	M	M
Canvasback	<i>Aythya valisineria</i>	RP	-	I	I	I		
Clapper rail	<i>Rallus longirostris</i>	RP	-	M	M	M		
Common eider*	<i>Somateria mollissima</i>	RP	-	X				
Greater scaup	<i>Aythya marila</i>	RP	-	I	I	I		
Harlequin duck*	<i>Histrionicus histrionicus</i>	-	-	X				
Lesser scaup	<i>Aythya affinis</i>	RP	-	I	I	I		
Long-tailed duck	<i>Clangula hyemalis</i>	RP	-	R	R	R		
Northern bobwhite	<i>Colinus virginianus</i>	RP	-		R	R	R	R
Northern pintail	<i>Anas acuta</i>	RP	-	I	I	I		
Surf scoter	<i>Melanitta perspicillata</i>	RP	-	R	R	R		
Virginia rail	<i>Rallus limicola</i>	RP	-	R	R	R	R	R
White-winged scoter	<i>Melanitta fusca</i>	RP	-	R	R	R		
Wood duck	<i>Aix sponsa</i>	RP	-		M	M	M	M
Fish								
Brook trout ♦	<i>Salvelinus fontinalis</i>		S3, G5			X		X

15 *Species considered regional priority, however, NJ is south of the species' normal winter range and there is no natural habitat. A few occur along man-made rock jettys each winter, but this is insignificant to the overall population status.

16 ♦Species is a New Jersey game species, but is also an excellent indicator of water quality.

17 RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

18 M: Maintain population, species occurs within specific habitat(s) of landscape region.

19 I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

20 R: Research and restore population, suitable habitat, species presence unknown.

21 X: Species present. Management strategy not yet determined.

(Appendix I continued)

Table W8. Fish Species

Note: Species identified within the table are nongame species within New Jersey, currently without state or regional status.

Common Name	Scientific Name	Regional Priority*	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Fish								
Comely shiner	<i>Notropis amoenus</i>	-	-			X		X
Cutlips minnow	<i>Exoglossum magilllingua</i>	-	-			X		X
Hickory shad	<i>Alosa mediocris</i>	-	S3, G5	X	X	X		X
Ironcolor shiner	<i>Notropis chaleybaeus</i>	-	S1S2, G4			X	X	X
Longnose gar	<i>Lepisosteus osserus</i>	-	-					X
Margined madtom	<i>Noturus insignis</i>	-	-		X	X	X	X
Northern hogsucker	<i>Hypentelium nigricans</i>	-	-					X
Pirate perch	<i>Aphroderus sayanus</i>	-	-				X	
Rainbow smelt	<i>Osmerus mordax</i>	-	SU, G5			X		
Shield darter	<i>Perca peltata</i>	-	-			X	X	X
Slimy sculpin**	<i>Cottus cognatus</i>	-	S3, G5			X		X

**Species has undergone Delphi review and has potential listing for state species of special concern.

X: Species present. Management strategy not yet determined.

Table W9. Game Species

Note: Species identified within the table have seasonal harvests within New Jersey and currently are not identified as regional priority species, but they are considered by DFW to be species of concern.

Common Name	Scientific Name	Regional Priority	State & Global Rank	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Mammals								
River otter	<i>Lutra canadensis</i>	-	-	M	M	M	M	M
Birds								
Ruffed grouse	<i>Bonasa umbellus</i>	-	-		R	R	R	R
Sora rail	<i>Porzana carolina</i>	-	-	R	R	R	R	R
Fish								
Brown trout*	<i>Salmo gairdneri</i> , <i>Salmo trutta</i> ,	-	-			X		X
Rainbow trout*	<i>Salmo gairdneri</i> , <i>Salmo trutta</i> ,	-	-			X		X

* Species are not native to New Jersey. Established breeding populations exist due to stocking for recreational use.

RP: Species of regional priority; currently mammals, reptiles, and insects are not identified due to information gaps.

M: Maintain population, species occurs within specific habitat(s) of landscape region.

I: Increase and stabilize population, species occurs within specific habitat(s) of landscape region.

R: Research and restore population, suitable habitat, species presence unknown.

X: Species present. Management strategy not yet determined.

1 (Appendix I continued)

2

3 **Table W10. Suites of Wildlife Species and their Location in New Jersey**

Suite	Members include but are not limited to	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Mammals						
Forest Dwelling Bats	Eastern pipistrel, Indiana bat, Northern long-eared bat, Small-footed myotis, red bat, silver-haired bat and hoary bat	X	X	X	X	X
Pinnipeds	Harbor seal	X				
Whales	Blue whale, Fin whale, Humpback whale, Right whale, Sei whale, Sperm whale	X				
Birds						
Beachnesting Birds	Black skimmer, Least tern, Piping plover, American Oystercatcher, Common Tern	X	X	X	X	
Interior Forest Cavity Nesters	Barred owl, Long eared owl, Pileated woodpecker		X	X	X	X
Savannah and Forest-edge Habitat Cavity Nesters	Red-headed woodpecker, Northern flicker, American kestrel, Great crested flycatcher, Eastern screech-owl, Prothonotary warbler		X	X	X	X
Coastal High Marsh Birds	Black rail, Henslow's sparrow, Marsh wren, Northern harrier, Saltmarsh sharp-tailed sparrow, Seaside sparrow, Sedge wren, American oystercatcher, Short-eared owl	X	X	X		
Coastal Low Marsh Birds	Saltmarsh sharp-tailed sparrow and seaside sparrow					
Colonial Waterbirds	Black-crowned night-heron, Caspian tern, Forster's tern, Glossy ibis, Great blue heron, Great egret, Little blue heron, Snowy egret, Tricolored heron, Yellow-crowned night-heron, Willet, Common tern, Green heron	X	X	X	X	X
Forest Passerines	Acadian flycatcher, Black-and-white warbler, Blackburnian warbler, Black-throated blue warbler, Black-throated green warbler, Canada warbler, Cerulean warbler, Chuck-will's-widow, Eastern wood-pewee, Hooded warbler, Kentucky warbler, Least flycatcher, Louisiana waterthrush, Northern parula, Pine warbler, Prothonotary warbler, Purple finch, Rose-breasted grosbeak, Scarlet tanager, Blue-headed vireo, Veery, Whip-poor-will, Winter wren, Wood thrush, Worm-eating warbler, Yellow-billed cuckoo, Yellow-throated warbler, Yellow-throated vireo		X	X	X	X
Freshwater Wetland Birds	American bittern, King rail, Least bittern, Pied-billed grebe, Sedge wren, Spotted sandpiper		X	X	X	X
Grassland Birds	Bobolink, Eastern kingbird, Eastern meadowlark, Field sparrow, Grasshopper sparrow, Henslow's sparrow, Northern harrier, Savannah sparrow, Upland sandpiper, Vesper sparrow, American kestrel		X	X	X	X

1 (Appendix I continued)

Suite	Members include but are not limited to	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Birds (continued)						
Grassland Birds	Bobolink, Eastern kingbird, Eastern meadowlark, Field sparrow, Grasshopper sparrow, Henslow's sparrow, Northern harrier, Savannah sparrow, Upland sandpiper, Vesper sparrow, American kestrel		X	X	X	X
Migratory Shorebirds	Red knot, Ruddy turnstone, Sanderling, Semipalmated sandpiper, Whimbrel	X	X	X		
Migratory Songbirds and Raptors		X	X	X	X	X
Pelagic and Seasonally Pelagic Birds	Audubon's Shearwater, Red-throated Loon, Horned Grebe	X	X			
Forest Raptors	Barred owl, Broad-winged hawk, Cooper's hawk, Long-eared owl, Northern goshawk, Red-shouldered hawk, Sharp-shinned hawk, Bald eagle, Long-eared owl, Red-shouldered hawk		X	X	X	X
Shrub-scrub/Open Field (3 - 7 year) Birds	Baltimore oriole, Black-billed cuckoo, Blue-winged warbler, Brown thrasher, Common nighthawk, Eastern towhee, Golden-winged warbler, Gray catbird, Horned lark, Least flycatcher, Prairie warbler, Willow flycatcher, Yellow-breasted chat, Indigo bunting, Common barn owl		X	X	X	X
Early Succession (0 -3 years) Open Field Birds	Upland sandpiper, Grasshopper sparrow, Bobolink; Henslow's sparrow, Savannah sparrow, Vesper sparrow and Eastern meadowlark are found in 2-5 yr early succession habitat					
Waterfowl	American black duck, Wood duck	X	X	X	X	X
Other	Peregrine falcon, Chimney swift, Common nighthawk, Cliff swallow	X	X	X	X	X
Reptiles						
Forest Dwelling Reptiles	<i>Snakes:</i> Corn snake, Timber rattlesnake, Northern pine snake, Northern copperhead, Eastern kingsnake, Coastal plain milk snake		X	X	X	X
Reptile Inhabitants of Wetland, Marsh and Bog	<i>Turtles:</i> Bog turtles, Eastern box turtle (???or make another category for open field type), Spotted turtle (??)		X	X	X	X
Reptiles Associated with water (lakes, ponds, streams)	<i>Snakes:</i> Queen snake <i>Turtles:</i> Wood turtles		X	X	X	X
Reptiles of Special Concern	Coastal plain milk snake, Eastern box turtle, Eastern kingsnake, Northern copperhead, Spotted turtle	X	X	X	X	X
Sea Turtles	Hawksbill turtle, Kemp's ridley sea turtle, Atlantic green sea turtle, Atlantic leatherback sea turtle, Atlantic loggerhead sea turtle	X				
Amphibians						
Amphibians of Special Concern	Carpenter frog, Fowler's toad, Jefferson salamander, marbled salamander, northern spring salamander	X	X	X	X	X

1 (Appendix I continued)

Suite	Members include but are not limited to	Atlantic Coastal Landscape	Delaware Bay Landscape	Piedmont Plains Landscape	Pinelands Landscape	Skylands Landscape
Amphibians (continued)						
Vernal Pool and Vernal Sinkhole Breeders	Obligate species: Jefferson salamander, blue-spotted salamander, spotted salamander, tiger salamander, marbled salamander, wood frogs, spadefoot toad Facultative species: Pine Barrens treefrog, spring peeper, southern or northern gray treefrog, green frog, southern leopard frog, pickerel frog, cricket frog, upland or NJ chorus frog, carpenter frog, bullfrog, American toad, Fowler's toad, four-toed salamander, red-spotted newt adults, long-tailed salamander, spotted turtles, painted turtles, snapping turtles, mud turtle	X	X	X	X	X
Non-vernal Sinkhole Inhabitants	Spring peeper, southern or northern gray treefrog, green frog, southern leopard frog, pickerel frog, cricket frog, upland or NJ chorus frog, carpenter frog, bullfrog, American toad, Fowler's toad, red-spotted newt adults, spotted turtles, painted turtles, snapping turtles		X		X	X
Limestone Fen Inhabitants	Bog turtle, long-tailed salamander, northern red salamander, green frog, bullfrog, spotted turtle, snapping turtle					X
Mollusks						
Mollusks of Special Concern	Creeper			X		X
Insects						
Lepidoptera of Federal or State Legal Status	Mitchell's satyr, Appalachian grizzled skipper, Bronze copper, Frosted elfin, Silver-bordered fritillary, Checkered white					
Lepidoptera of Special Concern	Dotted skipper, Harris's checkerspot, Hessel's hairstreak, northern metalmark, two-spotted skipper		X	X	X	X
Odonata Species			X	X	X	X
Fish						
Anadromous of Special Concern		X	X	X	X	X

X: Species suite occurs within identified landscape region.

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B. Appendix II: Status of New Jersey's Most Vulnerable Wildlife

The Strategy focuses on species recognized nationally, by the state, or regionally, as candidates at risk of population declines to unstable levels. The focus to maintain ecological integrity of natural communities and ecological biodiversity must incorporate the needs of those species at greatest risk of national, regional, or local extinction. This table identifies species that are currently identified as federal or state listed species.

Table W11. NJ's listed species and their status

Common Name	Scientific Name	Federally Endangered	Federally Threatened	State Endangered	State Threatened	State Special Concern
Mammals						
Indiana bat	<i>Myotis sodalis</i>	X		X		
Bobcat	<i>Lynx rufus</i>			X		
Black right whale	<i>Balaena glacialis</i>	X		X		
Blue whale	<i>Balaenoptera musculus</i>	X		X		
Fin whale	<i>Balaenoptera physalus</i>	X		X		
Humpback whale	<i>Megaptera novaeangliae</i>	X		X		
Sei whale	<i>Balaenoptera borealis</i>	X		X		
Sperm whale	<i>Physeter macrocephalus</i>	X		X		
Allegheny Woodrat	<i>Neotoma floridana magister</i>			X		
Birds						
American bittern	<i>Botaurus lentiginos</i>			Breeding only		Non-breeding only
American kestrel						Breeding only
Bald eagle	<i>Haliaeetus leucocephalus</i>		X	Breeding only	Non-breeding only	
Barred owl	<i>Strix varia</i>				X	
Black-crowned night heron	<i>Nycticorax nycticorax</i>				Breeding only	
Black-throated green warbler	<i>Dendroica virens</i>					Breeding only
Black rail	<i>Laterallus jamaicensis</i>				X	
Black skimmer	<i>Tynchops niger</i>			Breeding only	Non-breeding only	
Black tern	<i>Chlidonias niger</i>					Non-breeding only
Bobolink	<i>Dolichonyx oryzivorus</i>				Breeding only	
Broad-winged hawk	<i>Buteo platypterus</i>					Breeding only
Canada warbler	<i>Wilsonia Canadensis</i>					Breeding only
Caspian tern	<i>Sterna caspia</i>					Breeding only
Cerulean warbler	<i>Dendroica cerulea</i>					X
Cliff swallow	<i>Petrochelidon pyrrhonota</i>					Breeding only
Common barn owl	<i>Tyto alba</i>					X
Common nighthawk	<i>Chordeiles minor</i>					Breeding only
Common tern	<i>Sterna hirundo</i>					Breeding only
Cooper's hawk	<i>Accipiter cooperii</i>				Breeding only	Non-breeding only
Eastern meadowlark	<i>Sturnella magna</i>					Breeding only
Golden-winged warbler	<i>Vermivora chrysoptera</i>					X
Grasshopper sparrow	<i>Ammodramus savannarum</i>				Breeding only	Non-breeding only
Gray-cheeked thrush	<i>Catharus minimus</i>					Non-breeding only
Great blue heron	<i>Ardea herodias</i>					Breeding only
Henslow's sparrow	<i>Ammodramus henslowii</i>			X		
Horned lark	<i>Eremophila minimus</i>					Breeding only
Kentucky warbler	<i>Oporornis formosus</i>					X

1 (Appendix II continued)

Common Name	Scientific Name	Federally Endangered	Federally Threatened	State Endangered	State Threatened	State Special Concern
Birds (continued)						
King rail	<i>Rallus elegans</i>					Breeding only
Least bittern	<i>Ixobrychus exilis</i>					Breeding only
Least flycatcher	<i>Empidonax minimus</i>					Breeding only
Least tern	<i>Sterna antillarum</i>			X		
Little blue heron	<i>Egretta caerulea</i>					X
Loggerhead shrike	<i>Lanius ludovicianus</i>			X		
Long-eared owl	<i>Asio otus</i>				X	
Northern goshawk	<i>Accipiter gentiles</i>			Breeding only		
Northern harrier	<i>Circus cyaneus</i>			Breeding only		Non-breeding only
Northern parula	<i>Parula Americana</i>					Breeding only
Osprey	<i>Pandion haliaetus</i>				Breeding only	
Peregrine falcon	<i>Falco peregrinus</i>			X		
Pied-billed grebe	<i>Podilymbus podiceps</i>			Breeding only		Non-breeding only
Piping plover	<i>Charadrius melodus</i>	Breeding only	Non-breeding only	X		
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>				X	
Red knot	<i>Calidris canutus</i>				Non-breeding only	
Red-shouldered hawk	<i>Buteo lineatus</i>			Breeding only	Non-breeding only	
Roseate tern	<i>Sterna dougallii</i>	Breeding only	Non-breeding only	X		
Sanderling	<i>Calidris alba</i>					Non-breeding only
Savannah sparrow	<i>Passerculus sandwichensis</i>				Breeding only	
Sedge wren	<i>Cistothorus platensis</i>			X		
Sharp-shinned hawk	<i>Accipiter striatus</i>					Breeding only
Short-eared owl	<i>Asio flammeus</i>			Breeding only		Non-breeding only
Solitary vireo	<i>Vireo solitarius</i>					Breeding only
Spotted sandpiper	<i>Actitis macularia</i>					Breeding only
Tri-colored heron	<i>Egretta tricolor</i>					Breeding only
Upland sandpiper	<i>Batramia longicauda</i>			X		
Veery	<i>Catharus fuscescens</i>					Breeding only
Vesper sparrow	<i>Poocetes gramineus</i>			Breeding only	Non-breeding only	
Whimbrel	<i>Numenius phaeopus</i>					Non-breeding only
Winter wren	<i>Troglodytes troglodytes</i>					Breeding only
Yellow-breasted chat	<i>Icteria virens</i>					X
Yellow-crowned night heron	<i>Nyctanassa violaceus</i>				X	
Reptiles						
Atlantic green sea turtle	<i>Chelonia mydas</i>	Breeding only	Non-breeding only		X	
Atlantic leatherback sea turtle	<i>Dermochelys coriacea</i>	X		X		
Atlantic loggerhead sea turtle	<i>Caretta caretta</i>		X	X		
Bog turtle	<i>Glyptemys muhlenbergii</i>		X	X		
Coastal plains milk snake integrate	<i>Lampropeltis triangulum triangulum</i> x <i>L.t. elapsoides</i>					X
Corn snake	<i>Elaphe g. guttata</i>			X		
Eastern box turtle	<i>Terrapene c. Carolina</i>					X
Eastern kingsnake	<i>Lampropeltis g. getulus</i>					X
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	X		X		
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	X		X		

1 (Appendix II continued)

Common Name	Scientific Name	Federally Endangered	Federally Threatened	State Endangered	State Threatened	State Special Concern
Reptiles (continued)						
Northern copperhead	<i>Agkistrodon contortrix mokasen</i>					X
Northern diamondback terrapin	<i>Malaclemys t. terrapin</i>					X
Northern pine snake	<i>Pituophis m. melanoleucus</i>				X	
Queen snake	<i>Regina septemvittata</i>			X		
Spotted turtle	<i>Clemmys guttata</i>					X
Timber rattlesnake	<i>Crotalus h. horridus</i>			X		
Wood turtle	<i>Clemmys insculpta</i>				X	
Amphibians						
Blue-spotted salamander	<i>Ambystoma laterale</i>			X		
Carpenter frog	<i>Rana virgatipes</i>					X
Eastern mud salamander	<i>Pseudotriton montanus</i>				X	
Eastern tiger salamander	<i>Ambystoma tigrinum</i>			X		
Fowlers toad	<i>Bufo woohousii fowleri</i>					X
Jefferson salamander	<i>Ambystoma jeffersonianum</i>					X
Long-tailed salamander	<i>Eurycea longicauda</i>				X	
Marbled salamander	<i>Ambystoma opacum</i>					X
Northern spring salamander	<i>Gyrinophilus p. porphyriticus</i>					X
Pine barrens treefrog	<i>Hyla andersonii</i>				X	
Southern gray treefrog	<i>Hyla chrysocelis</i>			X		
Mollusks						
Brook floater	<i>Alasmidonta varicose</i>			X		
Creeper	<i>Strophitus undulatus</i>					X
Dwarf wedgemussel	<i>Alasmidonta heterodon</i>	X		X		
Eastern lampmussel	<i>Lampsilis radiata</i>				X	
Eastern pondmussel	<i>Ligumia nasuta</i>				X	
Green floater	<i>Lasmigona subviridis</i>			X		
Tidewater mucket	<i>Leptodea ochracea</i>				X	
Triangle floater	<i>Alasmidonta undulata</i>				X	
Yellow lampmussel	<i>Lampsilis cariosa</i>				X	
Insects						
American burying beetle	<i>Nicrophorus mericanus</i>	X		X		
Appalachian grizzled skipper	<i>Pyrgus wyandot</i>			X		
Arogos skipper	<i>Atrytone arogos arogos</i>			X		
Bronze copper	<i>Lycaena hyllus</i>			X		
Checkered white	<i>Pontia protodice</i>				X	
Dotted skipper	<i>Hesperia attalus slossonae</i>					X
Frosted elfin	<i>Callophrys irus</i>				X	
Georgia (Lakehurst) satyr	<i>Neonympha areolatus septentrionalis</i>					X
Harris checkerspot	<i>Chlosyne harrisii</i>					X
Hessel's hairstreak	<i>Callophrys hesseli</i>					X
Hoary elfin	<i>Callophrys polios</i>					X
Mitchell's satyr	<i>Neonympha m. mitchellii</i>	X		X		
Northeastern beach tiger beetle	<i>Cincindela d. dorsalis</i>		X	X		
Northern metalmark	<i>Calephelis borealis</i>					X
Silver-bordered fritillary	<i>Bolaria selene myrina</i>				X	
Two-spotted skipper	<i>Euphyes bimacula</i>					X

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(Appendix II continued)

Common Name	Scientific Name	Federally Endangered	Federally Threatened	State Endangered	State Threatened	State Special Concern
Fish						
Shortnose sturgeon	<i>Acipenser brevirostrum</i>	X		X		

C. Appendix III: Geology of New Jersey

New Jersey's Geology

The foundation of the New Jersey's diverse landforms was built over the course of millions of years of expanding and receding glaciers, extending and deepening rivers, rising and falling sea levels, eroding beach sand, geologic faults, and volcanoes. Present-day New Jersey reflects geologic processes that began more than 500 million years ago, with the deposition of sand, mud, and lime sediment from Paleozoic seas and floodplains, and continues today with the erosion and movement of sand to shape and reshape the barrier islands.

The New Jersey Geological Survey divides New Jersey into four distinctive physiographic provinces: Valley and Ridge, Highlands, Piedmont, and Coastal Plain.

Valley and Ridge Province

Ancient seas and floodplains during the Cambrian to Devonian, deposited sand, mud, and lime sediment on the landform that is now northwestern New Jersey. In the 570 to 345 million years since initially deposited, sedimentary layers of sandstone, shale, and limestone formed and have compressed into folds and thrust along faults to form linear belts. These belts of erosion-resistant sandstone and easily-eroded shale and limestone underlie the long, parallel ridges and valleys of northwestern New Jersey, that include the Kittatinny Ridge, the Walpack Ridge, and Flat Brook Valley.

Highlands Province

An escarpment divides the Highlands from the Valley and Ridge Provinces from Franklin to the Delaware River, north of Phillipsburg. The Highlands have the oldest rocks in New Jersey – granite, gneiss, and marble that were formed in the Precambrian, between 1.3 billion and 750 million years ago. Granite and gneiss are resistant to erosion and have persisted while streams and rivers have created the deep, steep-sided valleys. The long, parallel ridges and valleys that extend through the Highlands include Bearfort Mountain, Long Valley, and the Musconetcong Valley.

Piedmont Province

The Piedmont is separated from the Highlands by a series of major faults, including the Ramapo Fault. A prominent escarpment on the northwest side of the faults marks the extent of the Highlands. Below the faults, sandstone, shale, conglomerate, basalt, and diabase are the foundation of the broad lowland and intermittent ridges of the Piedmont. These rocks are of the Late Triassic and Early Jurassic age, 230 to 90 million years old. The rocks reside on a crustal block that dropped during the initial stages of the opening of the Atlantic Ocean. Volcanic activity created erosion-resistant basalt and diabase substrates. Basalt and diabase underlie the Palisades, Rocky Hill, Sourland Mountain, and Cushtunk Mountain and shale and sandstone-lined valleys and lowlands between them.

1 (Appendix III continued)

3 **Coastal Plain Province**

4 The unconsolidated sand, silt, and clay sediments of the Coastal Plain Province coincide with the
5 rocks of the Piedmont Plains between Carteret and Trenton. These sediments were deposited in
6 ancient river deltas and marine conditions from Cretaceous to Miocene, 135 to 5.3 million years
7 ago, and extend past the coastline to the edge of the Continental Shelf. Late Tertiary and
8 Quaternary rivers deposited sand and gravel that cover much of the Coastal Plain. The New
9 Jersey coastline is the result of a rapid post-glacial rise in sea level that slowed 6,000 years ago.

11 **Recent Glaciations**

12 During the past two million years there have been three glaciations. The most recent glacier, the
13 late Wisconsinian advance, began to recede approximately 20,000 years ago from Harmony
14 across to Morristown and to the mouth of the Raritan River. Glacial deposits cover much of the
15 substrate north of the extent of the glacier. Till, an unsorted mixture of sand, clay and boulders,
16 covers much of the uplands. Sand and gravel from glacial meltwater and silt and clay fill the
17 valleys and lowlands. Patches of till from older glaciations dot the landscape beyond extent of
18 the late Wisconsinian advance.

20 **Geologic Activities Today**

21 The dynamic barrier islands have been formed by erosion and deposition of beach sand by waves
22 and currents, while rivers deposit mud and sand in the bays and estuaries, expanding New
23 Jersey's extensive brackish wetlands.

24
25 More information about the geology of New Jersey is available from the New Jersey Geological
26 Survey Web site:

27
28 www.state.nj.us/dep/njgs

29
30 Or by contacting:

31
32 New Jersey Geological Survey
33 29 Arctic Parkway
34 P.O. Box 427
35 Trenton, NJ 08625
36 (609) 292-1185 or (609) 633-1004 (fax)

D. Appendix IV: Definitions

1. Atlantic population (with reference to Canada geese): Atlantic population of Canada Geese refers to the population of Canada geese that breeds in the arctic or sub arctic and migrate through or winter in New Jersey and are distinct from the resident population of Canada Geese that resides year-round in New Jersey and breeds in New Jersey parks and grasslands.
2. Biodiversity: Biological diversity (biodiversity) is the variety of life on Earth and the interactions, cycles, and processes of nature that link it all together. In its broadest definition, biodiversity includes individual species, genetic diversity within species, natural communities in which these species interact, and the ecosystems and landscapes in which species evolve and coexist.
3. Best Management Practices, or BMPs: A collection of management approaches implemented in the course of land management that minimize injury to rare wildlife, and maintain or enhance the value of habitat, for rare wildlife populations.
4. Cluster development: Residential community where homes are built in high density within a restricted portion of the development while leaving a large portion of the land in its natural state.
5. Critical areas: Area ranked as “1” through “5” in the Landscape Project. See the following sections in Appendix III-E for further information: “General Methodology for Delineating Critical Areas,” “Detailed Methodology for Delineating Critical Areas by Habitat Type,” and “Detailed Methodology for Delineating Critical Areas by Special Habitat Requirements.”
6. Critical habitat: Habitat that is essential to the persistence and recovery of rare species populations.
7. Habitat Conservation Plan: A method of mitigating loss of wildlife (and particularly, endangered species) habitat, which usually includes significantly improving habitat to compensate for the value of habitat lost.
8. Large Acre Lot Zoning: A change in the zoning of residential building requirements by municipalities or townships from small lots, generally ¼ to ½ acre, to large lots, generally 5 to 10 acres to restrict development and population growth within that locality.
9. Macrosite: A large area, generally hundreds to thousands of acres, containing two or more sites that have some geographical and ecological connection relevant to conservation planning for a rare species. Rare species populations within a macrosite are generally close to one another but are not necessarily contiguous.
10. Priority species: Nongame species considered by the DEP to be species of special concern as determined by a panel of experts. The term also includes species of regional concern within regional conservation plans such as Partners in Flight Bird Conservation Plans, North American Waterbird Conservation Plan, United States Shorebird Conservation Plan, etc.

1 **(Appendix IV continued)**

2 11. Restoration: the process of re-establishing the functional aspects of a given ecosystem to
3 a semblance of its pre-disturbed state.

4 12. Significant habitat: Areas of land and water habitat that support unique assemblages or
5 concentrations of wildlife of conservation concern. Many of these habitats are necessary
6 to sustain state and regional populations.

7 13. Subsidized predators: Native species whose populations in some parts of their range are
8 able to survive and, in some cases, expand, due in part to resources provided by humans.
9

E. Appendix V: Participants in the Development of the CWCS

The development of the NJ CWCS began with four existing strengths of the NJ Division of Fish and Wildlife's Endangered Species Program (ENSP) (see Overview, page 3), and then continued through the enlistment and participation of organizations, workgroups, and stakeholders (Table 1 below). The ENSP coordinated the meetings, enlisted comments and review from numerous participants, and revised the CWCS as comments were received and accepted.

Specific tasks of the ENSP include:

- Provide guidance to reviewers and help to maintain the focus on the purpose of the CWCS while encouraging comments and recommendations;
- Identifying potential partners and interested parties to accomplish the goals and actions set forth within the CWCS;
- Facilitate discussions with and input from agency wildlife staff both within (e.g., Bureau of Wildlife Management, Bureau of Freshwater Fisheries, and outside (e.g., U.S.F.W.S. Ecological Services and Refuges staff) regarding the development CWCS.
- Initiate and define the format and intent of the Wildlife Summit;
- Provide guidance in structuring the criteria for species of conservation priority, the plan revision process, and review of written drafts.

The Division of Fish and Wildlife (DFW) will conduct a detailed evaluation of the CWCS progress concerning species status, on-going threats, and partnership successes every five years. A Wildlife Summit will be held whereby partners and key stakeholders will be asked to participate in the reviews. Public input will be solicited using online surveys and/or open forum meetings.

(Appendix V continued)

Table 1: Summary of CWCS development

Date	Activity
Spring – Summer 2004	ENSP worked with consultant, Gideon Lachman, formerly a member of the International Association of Fish and Wildlife Agencies, to develop the first “outline draft” and general protocol for the CWCS, to develop the basis of NJ’s CWCS.
September 9, 2004	CWCS DRAFT
September 2004	ENSP solicited review and recommendations from each of the Bureaus within the NJ Division of Fish and Wildlife
November 15, 2004	CWCS REVISED DRAFT
November 2004	ENSP solicited review and recommendations from: <ol style="list-style-type: none"> 1) Endangered and Nongame Species Program Advisory Committee (ENSAC) (see Overview, page 4), including NJ Audubon Society and the Nature Conservancy-NJ Chapter representing their constituencies, the NJ Conservation Foundation, academia, and public representatives 2) NJ Department of Environmental Protection (NJ DEP), Land Use Regulation Program, Office of Natural Lands Management, Natural Heritage Program, Division of Forestry, Division of Parks and Forestry, Division of Watershed Management 3) US Fish and Wildlife Service (New Jersey Field Office), 4) National Park Service (Gateway National Recreation Area – Sandy Hook Unit, Delaware Water Water Gap National Recreation Area - Millbrook) 5) US Department of Agriculture, Animal and Plant Health Inspection Service (APHIS) and Natural Resources Conservation Service (NRCS) 6) Pinelands Commission 7) National Wildlife Refuges (NWR) (Edwin B. Forsythe NWR, Cape May NWR, Supawna Meadows NWR, Great Swamp NWR, Walkill NWR) 8) Military bases or US Coast Guard natural resource managers (U.S. Coast Guard Training Center, Cape May, New Jersey and Picatinny Arsenal)
December 6, 2004	ENSP met with NJ Audubon Society, the Nature Conservancy-NJ Chapter, and the NJ Conservation Foundation to discuss comments and recommendations.
December 14, 2004	ENSP met with ENSAC to discuss comments and recommendations.
December 2004 – January 2005	ENSP solicited review by NJ Future
February – March 2005	Reviewed by Martin McHugh, Director of Fish and Wildlife and the NJ DEP Commissioner’s office
March 8, 2005	CWCS REVISED DRAFT

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(Appendix V continued)

Date	Activity
April 2005	<p>Wildlife Summit held to assemble a broad range of government and citizen organizations to foster discussion and provide recommendations regarding New Jersey wildlife conservation issues.</p> <p>A. Private environmental, planning wildlife groups:</p> <ol style="list-style-type: none"> 1. NJ Audubon Society 2. The Nature Conservancy-NJ Chapter 3. The NJ Conservation Foundation 4. New Jersey Council of Watershed Associations <ol style="list-style-type: none"> a. Stonybrook Millstone Watershed Association b. South Branch Watershed Association 5. Pinelands Preservation Alliance 6. Highlands Coalition – NJ Chapter 7. Association of NJ Environmental Commissions 8. American Littoral Society 9. American Museum of Natural History 10. NJ Farm Bureau 11. Wildlife Conservation Society 12. Passaic River Coalition 13. NJ Forestry Association 14. NJ State Federation of Sportsmen’s Clubs 15. Ducks Unlimited 16. Wildlife Trust 17. NJ State Council of Trout Unlimited 18. Ruffed Grouse Society 19. Conserve Wildlife Foundation of New Jersey 20. Citizens United to Protect the Maurice River and its Tributaries, Inc. <p>B. Land Conservancies</p> <ol style="list-style-type: none"> 1. Trust for Public Lands 2. Delaware and Raritan Greenway 3. Conservation Resources, Inc. 4. Natural Lands Trust, Phila. Conservationists, Inc. <p>C. Regional Organizations</p> <ol style="list-style-type: none"> 1. Sourland Planning Council 2. Delaware Valley Regional Planning Commission <p>D. State Agencies</p> <ol style="list-style-type: none"> 1. Office of Smart Growth 2. Department of Transportation, Division of Project Planning and Development 3. Office of the Governor, Ben Brickner 4. Office of U.S. Senator Frank Lautenberg, Lisa Plevin

1 (Appendix V continued)

Date	Activity
April 2005 (continued)	<p>E. Other NJ DEP staff</p> <ol style="list-style-type: none"> 1. Green Acres 2. Land Use Regulation Program 5. Office of Natural Lands Management, Natural Heritage Program 6. NJ State Forest Service 7. Division of Parks and Forestry 8. Division of Watershed Management, 9. Division of Water Quality, Municipal Finance, and Construction Element 10. Division of Water Quality, Municipal Finance/ Land Acquisition 11. NJ Natural Lands Trust 12. Office of Science and Research 13. Invasive Species Task Force <p>F. Local officials, through:</p> <ol style="list-style-type: none"> 1. County Planning Offices <ol style="list-style-type: none"> a. Passaic County <p>G. Park Commissions/ Systems (Natural Resource managers)</p> <ol style="list-style-type: none"> 1. Morris County Park Commission 2. Ocean County Department of Parks and Recreation 3. Somerset County Park Commission 4. Hunterdon County Park System 5. Cattus Island Ocean County Park <p>H. Planning and engineering consultants and land use attorneys –</p> <ol style="list-style-type: none"> 1. Amy S. Greene Environmental Consultants, Inc. 2. Banisch Associates 3. JM Huber Corporation 4. Maser Consulting PA <p>I. Private foundations</p> <ol style="list-style-type: none"> 1. Doris Duke Charitable Foundation 2. Geraldine R. Dodge Foundation 3. FM Kirby Foundation <p>J. Academia</p> <ol style="list-style-type: none"> 1. Academics from Rutgers University, Cook College: <ol style="list-style-type: none"> a. Ted Stiles, Ph.D., Professor of Ecology, Evolution and Natural Resources b. Julie Lockwood, Ph.D., Professor of Ecology, Evolution and Natural Resources c. Rick Lathrop, Ph.D., Center for Remote Sensing and Spatial Analysis <p>K. International Association of Fish and Wildlife Agencies, David Chadwick</p>

1 (Appendix V continued)

Date	Activity
April 2005 (continued)	<p>L. Federal Organizations</p> <ol style="list-style-type: none"> 1. US Fish and Wildlife (NJ Field Office) 2. National Park Service <ol style="list-style-type: none"> a. Gateway National Recreation Area – Sandy Hook Unit b. Delaware Water Water Gap National Recreation Area - Millbrook 3. US Department of Agriculture <ol style="list-style-type: none"> a. Animal and Plant Health Inspection Service (APHIS) b. Natural Resources Conservation Service (NRCS) 4. National Wildlife Refuges (NWR) <ol style="list-style-type: none"> a. Edwin B. Forsythe NWR b. Cape May NWR c. Great Swamp NWR d. Walkill NWR <p>Organizations invited, but unable to attend the Summit include:</p> <p>A. Private environmental, planning wildlife groups:</p> <ol style="list-style-type: none"> 1. New Jersey Council of Watershed Associations <ol style="list-style-type: none"> a. Upper Delaware River Watershed Assoc. b. Great Swamp Watershed Association c. Passaic River Coalition, Ella Fillipone d. Environmental Defense 2. Sierra Club 3. Regional Plan Association 4. Regional Planning Partnership 5. RiverKeepers: <ol style="list-style-type: none"> a. Delaware b. Hudson Riverkeepers 6. Hackensack Baykeeper 7. The Watershed Institute 8. Clean Ocean Action 9. Alliance for a Living Ocean 10. Barnegat Bay Estuary Program 11. The Jacques Cousteau National Estuarine Reserve 12. NJ Environmental Lobby 13. Wetlands Institute 14. Delaware River Basin Commission (DRBC) 15. NJ Soil Conservation Service 16. Council on Affordable Housing and the Environment 17. Quail Unlimited 18. National Wild Turkey Federation 19. Pheasants Forever 20. Knee Deep Club

1 (Appendix V continued)

Date	Activity
April 2005 (continued)	<p>B. Land Conservancies</p> <ol style="list-style-type: none"> 1. Morris Land Conservancy <p>C. Regional Organizations</p> <ol style="list-style-type: none"> 1. Highlands Council 2. Meadowlands Commission 3. Raritan Highlands Compact 4. Great Swamp Watershed Organization <p>D. State Agencies</p> <ol style="list-style-type: none"> 1. Board of Public Utilities 2. Palisades Interstate Park Commission-NJ 3. Pinelands Commission <p>E. Other NJ DEP staff</p> <ol style="list-style-type: none"> 1. Office of Policy and Planning 2. Invasive Species Task Force 3. Wetlands Program 4. Office of (Coastal) Engineering and Construction 5. CAFRA 6. Bureau of Water Monitoring and Standards <p>F. Representatives from federal agencies</p> <ol style="list-style-type: none"> 1. U.S. Army Corps of Engineers (both NY and Philadelphia districts) 2. National and Oceanic Atmospheric Administration (NOAA) Fisheries <p>G. Local officials, through:</p> <ol style="list-style-type: none"> 1. League of Municipalities, 2. New Jersey Conference of Mayors 3. County Planning Offices <ol style="list-style-type: none"> a. Hunterdon b. Burlington <p>H. Park Commissions (Natural Resource managers)</p> <ol style="list-style-type: none"> 1. Monmouth County Park Commission 2. Atlantic County Park Commission 3. Union County Park Commission <p>I. Planning and engineering consultants and land use attorneys –</p> <ol style="list-style-type: none"> 1. Howard Cohen , Esq. 2. Rutgers Environmental Law Clinic <p>J. GIS groups</p> <ol style="list-style-type: none"> 1. The New Jersey Office of Information Technology, Initiative for Community Access to Technology (ICAT) <p>K. Private foundations</p> <ol style="list-style-type: none"> 1. Surdna 2. William Penn 3. Fund for NJ 4. Victoria Foundation

1 (Appendix V continued)

Date	Activity
April 2005	<p>L. Academia</p> <ol style="list-style-type: none"> 1. Academics from Rutgers University, Cook College <ol style="list-style-type: none"> a. David Drake and Joe Paulin (Rutgers Cooperative Extension) b. Colleen Hatfield, Ph.D., Ecology, Evolution and Natural Resources c. Joan Ehrenfeld, Ph.D., Ecology, Evolution and Natural Resources 2. Princeton University <ol style="list-style-type: none"> a. Tony Shorris, Director, Policy Research Institute for the Region b. David Wilcove, Professor of Public Affairs and Ecology and Evolutionary Biology 3. Rutgers Cooperative Extension Service – NJ Sea Grant 4. Richard Stockton College/Center for Coastal and Environmental Studies 5. Monmouth University, Paul Gaffney, President w 6. Ramapo State College 7. Municipal Land Use Center, The College of New Jersey, Marty Bierbaum, Executive Director 8. NJ School of Conservation and the NJ School of Conservation Research Organization – Academy of Natural Sciences <p>M. Utilities</p> <ol style="list-style-type: none"> 1. NJ Utilities Association <p>N. Federal Organizations</p> <ol style="list-style-type: none"> 1. National Wildlife Refuges (NWR) <ol style="list-style-type: none"> a. Supawna Meadows NWR 2. Military bases or US Coast Guard natural resource managers <ol style="list-style-type: none"> a. U.S. Coast Guard Training Center, Cape May, New Jersey b. US Army Armament Research Development and Engineering Center (Picatinny Arsenal)
May 5, 2005	CWCS REVISED DRAFT
May 2005	Review by Martin McHugh, Director of Fish and Wildlife and the office of the NJ DEP Commissioner
July 1, 2005	CWCS REVISED DRAFT
July 2005	Review by ENSP staff, receipt of additional comments and recommendations from external sources
August 3, 2005	CWCS REVISED DRAFT
August 2005	Review by Martin McHugh, Director of Fish and Wildlife and Commissioner Bradley Campbell, NJ DEP

(Appendix V continued)

Table 2: Schedule of CWCS reviews and revisions

FY05	FY06	FY07	FY08	FY09	FY10
July 1, 2004- June 30, 2005	July 1, 2005- June 30, 2006	July 1, 2006- June 30, 2007	July 1, 2007- June 30, 2008	July 1, 2008- June 30, 2009	July 1, 2009- June 30, 2010
Develop CWCS	Submit CWCS for approval September 2005				
FY11	FY12	FY13	FY14	FY15	FY16
July 1, 2010- June 30, 2011	July 1, 2011- June 30, 2012	July 1, 2012- June 30, 2013	July 1, 2014- June 30, 2015	July 1, 2015- June 30, 2016	July 1, 2016- June 30, 2017
Review CWCS with partners and public in winter 2011; Revise CWCS by June 30, 2011					Review CWCS with partners and public in winter 2017; Revise CWCS by June 30, 2017
The NJ Division of Fish and Wildlife (DFW) intends the CWCS to be a dynamic document under on-going review both internally and by New Jersey's conservation community, and citizenry. Periodic amendments will be made to adapt and respond to unforeseen conservation threats and to assure that continued progress to achieving the set forth within this document.					

F. Appendix VI: Landscape Project

New Jersey's Landscape Project

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

James E. McGreevy, Governor
Bradley M. Campbell, Commissioner
John S. Watson Jr., Assistant Commissioner

DIVISION OF FISH AND WILDLIFE

Martin McHugh, Director
David Chanda, Assistant Director

ENDANGERED AND NONGAME SPECIES ADVISORY COMMITTEE

Jane Morton Galetto, Chairperson
James Applegate, Ph.D.
Joanna Burger, Ph.D.
Michael Catania
Emile DeVito, Ph.D.
Janet Larson
Rick Lathrop, Ph.D.
David Mizrahi, Ph.D.
Dale Schweitzer, Ph.D.
James Shissias
Clay Sutton

ENDANGERED AND NONGAME SPECIES PROGRAM STAFF

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Kathy Clark, Principal Zoologist
Dave Jenkins, Principal Zoologist
Michael Valent, Principal Zoologist
Jeanette Bowers-Altman, Senior Zoologist
Amanda Dey, Senior Biologist
David Golden, Senior Biologist
Kris Schantz, Senior Biologist
Melissa Craddock, Assistant Biologist
Sharon DeFalco, Assistant Biologist
Kimberly Korth, Assistant Biologist
Todd Pover, Assistant Biologist
Larissa Smith, Assistant Biologist
Brian Zarate, Assistant Biologist
Gretchen Fowles, GIS Specialist
Peter Winkler, GIS Specialist
Patrick Woerner, GIS Specialist
Linda Tesauro, Foundation Director
Patricia B. Shapella, Contributions Manager
Keara Gianotti, Development Associate
Terry Terry, Head Clerk

New Jersey Department of Environmental Protection
Division of Fish and Wildlife
Endangered and Nongame Species Program
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Trenton, NJ 08625-0400
(609) 292-9400
Fax (609) 984-1414

CWCS pages 579 - 637 www.njfishandwildlife.com/ensphome.htm

The Landscape Project has been supported by:

US Fish and Wildlife Service
Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act)
Partnerships for Wildlife Act

NJ Department of Environmental Protection,
Division of Science, Research and Technology
Division of Watershed Management
Office of Natural Resource Damage Assessment

National Fish and Wildlife Foundation

Geraldine R. Dodge Foundation

Conserve Wildlife Foundation of NJ

The citizens of New Jersey who have purchased the Conserve Wildlife License Plate, checked-off for wildlife on their state income tax return or made a direct donation to the Endangered and Nongame Species Program (ENSP) or the Conserve Wildlife Foundation.

The following Division of Fish and Wildlife staff have contributed to the Landscape Project:

Larry Niles, ENSP Bureau Chief; James Sciascia, Information and Education Bureau Chief; Kathleen Clark, Principal Zoologist; David Jenkins, Principal Zoologist; Michael Valent, Principal Zoologist; Jeanette Bowers-Altman, Senior Zoologist; Amanda Dey, Senior Biologist; David Golden, Senior Biologist; Kris Schantz, Senior Biologist; Jason Tesauro, Senior Biologist; Melissa Craddock, Assistant Biologist; Sharon DeFalco, Assistant Biologist; Kimberly Korth, Assistant Biologist; Todd Pover, Assistant Biologist; Larissa Smith, Assistant Biologist; Brian Zarate, Assistant Biologist; William Bogetti, GIS Specialist; Gretchen Fowles, GIS Specialist; Peter Winkler, GIS Specialist; Patrick Woerner, GIS Specialist; Terry Terry, Head Clerk.

Maps and methodologies described in this document have been peer reviewed by:

Dr. James Applegate, Rutgers University; Dr. Joanna Burger, Rutgers University; Dr. Tim Casey, Rutgers University; Dr. David Ehrenfeld, Rutgers University; Dr. Joan Ehrenfeld, Rutgers University; Dr. David Fairbrothers, Rutgers University; Dr. Michael Gochfeld, Rutgers University; Ernie Hahn, DEP, Land Use Regulation Program; Dr. Colleen Hatfield, Rutgers University; Dr. Marjorie Kaplan, DEP, Division of Science, Research and Technology; Dr. Michael W. Klemens; Wildlife Conservation Society; Kim Laidig, NJ Pinelands Commission; Dr. Richard Lathrop, Rutgers University; Trish Maggio and Jessica Sanchez, NJ Office of State Planning; Dr. Peter Morin, Rutgers University; Larry Torok, DEP, Land Use Regulation Program; and Dr. Robert Zampella, NJ Pinelands Commission.

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Cover art by Steve Oleszek

Definitions

critical areas - any area ranked as “1” through “5” in the Landscape Project. See the following sections of this document for further information: “General Methodology for Delineating Critical Areas,” “Detailed Methodology for Delineating Critical Areas by Habitat Type,” and “Detailed Methodology for Delineating Critical Areas by Special Habitat Requirements.”

endangered species - a species listed on the official endangered wildlife list that the Department promulgates pursuant to the Endangered and Nongame Species of Wildlife Conservation Act of 1973 (ENSCA).

imperiled species - includes all endangered and threatened wildlife species.

priority species - nongame wildlife that are considered by the Department to be species of special concern as determined by a panel of experts. The term also includes wildlife species of regional concern in regional conservation plans such as Partners in Flight Bird Conservation Plans, North American Waterbird Conservation Plans, United States Shorebird Conservation Plan, etc.

threatened species - a species designated as “threatened” on the list of nongame wildlife species that the Department promulgates pursuant to ENSCA.

Conversions

Area:

1 hectare = 2.47 acres

Distance:

1 meter = 3.28 feet

1 kilometer = 0.62 miles

The Landscape Project

a model for imperiled wildlife protection (Version 2.0)

New Jersey is the most densely populated state in the nation. One of the consequences of this distinction is the extreme pressure that is placed on our natural resources. As the population grows, we continue to lose or impact the remaining natural areas of the state. As more and more habitat is lost, people are beginning to appreciate the benefits — and necessity — of maintaining land in its natural state. For example, we now know that wetlands play an important role in lessening the damage from floods and naturally breaking down contaminants in the environment. Forests and grasslands protect the quality of our drinking water, help purify the air we breathe and provide important areas for outdoor recreation.

Collectively, these habitats are of critical importance to the diverse assemblage of wildlife found in New Jersey, including more than 70 species classified as threatened or endangered. In 1994, the New Jersey Department of Environmental Protection (DEP) adopted a landscape level approach to imperiled species conservation that was created by the Division of Fish and Wildlife's Endangered and Nongame Species Program. The goal is to protect New Jersey's biological diversity by maintaining and enhancing imperiled wildlife populations within healthy, functioning ecosystems.

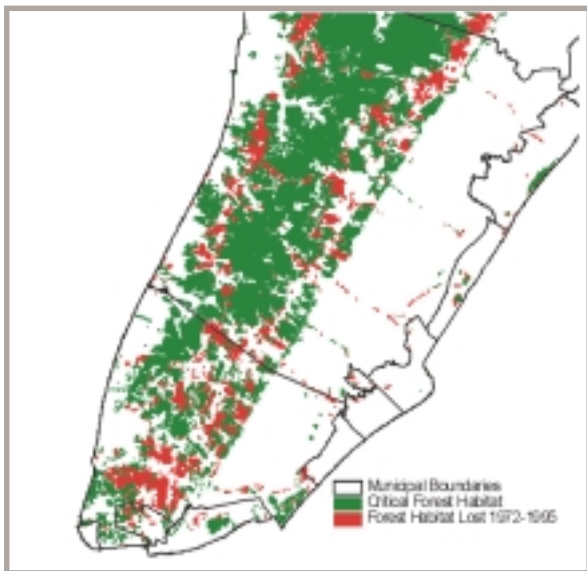


Figure 1. Over 50% of the state's bog turtle habitat (top) and 40% of the Cape May Peninsula's migratory bird habitat (bottom) has been lost to sprawl in the past three decades. The Landscape Project aims to reverse this trend.

Why we need the Landscape Project

As people leave our cities to live in the "country," suburban sprawl has consumed land at a rapid rate. Some analysts predict that at current patterns all remaining available land would be developed within 40 years, making New Jersey possibly the first state in the nation to reach build-out (Hasse and Lathrop 2001). In New Jersey, such sprawl is evident as analyses based on aerial photographs between 1985 and 1996 found that rural single unit residential growth was responsible for 30% of the new development in the state (Hasse and Lathrop 2001). See **Appendix I** for a discussion of habitat fragmentation.

Despite New Jersey's protection efforts, which include strict land-use regulations and an aggressive open space acquisition program (Green Acres), we continue to lose critical wildlife habitat at an alarming rate. In just the last three decades we have lost 40% of the remaining critical migratory bird stopover habitat on the lower third of the Cape May Peninsula. During the same period, approximately 50% of the state's bog turtle habitat has disappeared (**Figure 1**). The Landscape Project serves as a tool to help reverse this trend (**Figure 2**).

New Jersey's Changing Landscape

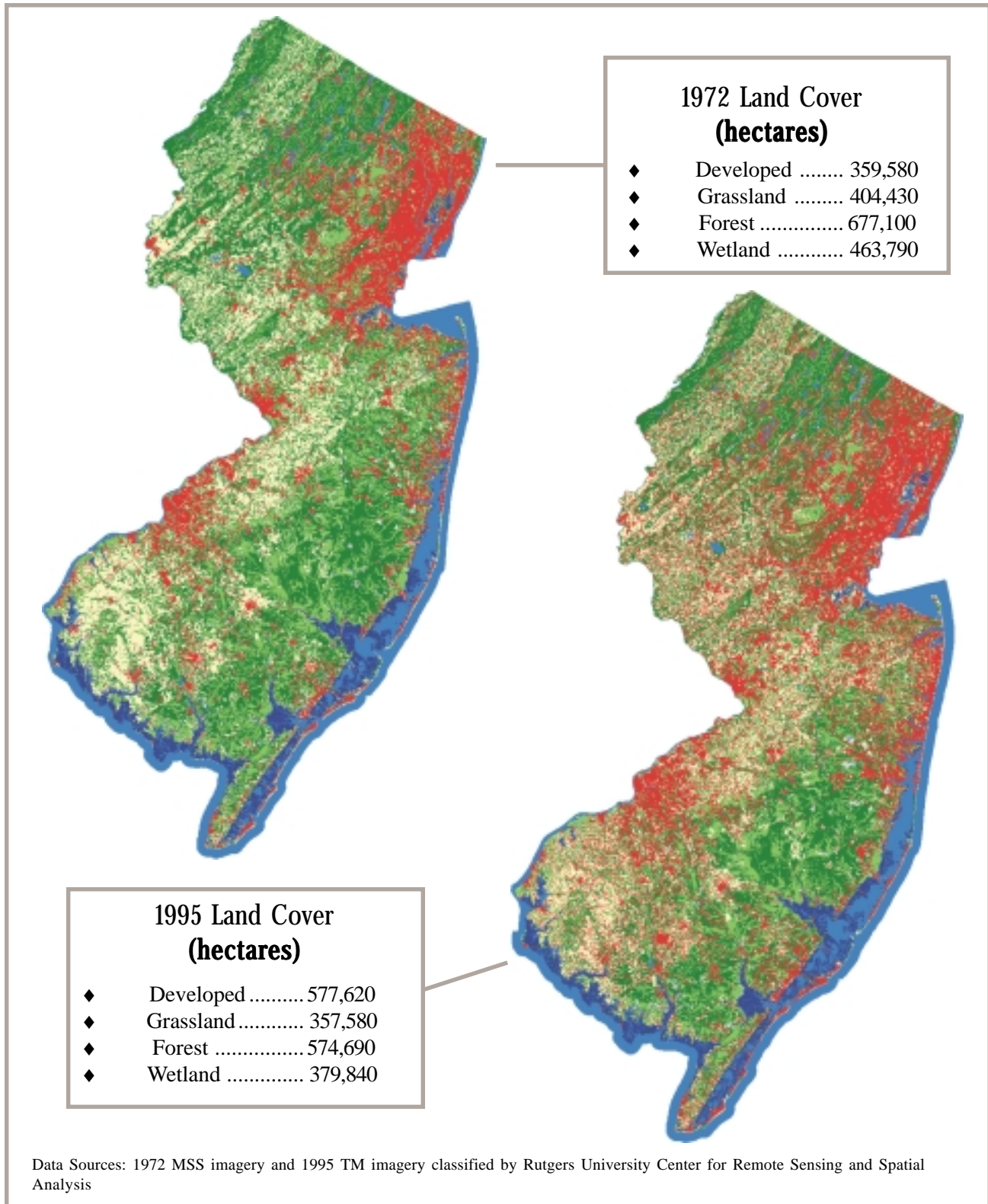


Figure 2. New Jersey's landscape is rapidly changing. Since 1972, more than 8,000 hectares/year of wildlife habitat has been lost. Moreover, much of the habitat that remains is less suitable for wildlife due to habitat fragmentation. This is especially detrimental to imperiled wildlife, as many of these species require large, contiguous blocks of habitat to survive. The goal of the Landscape Project is to reverse this trend by identifying, delineating and ultimately protecting habitat critical to the long-term survival of New Jersey's wildlife.

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The purpose of the Landscape Project

The Landscape Project has been designed to provide users with peer-reviewed, scientifically sound information that is easily accessible and can be integrated with planning, protection and land management programs at every level of government — state, county and municipal, as well as non-governmental organizations and private landowners. As in Version 1.0, Version 2.0 of the Landscape Project has gone through an extensive peer review process. Landscape maps and overlays provide a basis for proactive planning, such as the development of local habitat protection ordinances, zoning to protect critical wildlife areas, management guidelines for imperiled species conservation on public and private lands and land acquisition projects.

Most importantly, the critical area information that Landscape Project products provide can be used for planning purposes before any actions such as proposed development, resource extraction (eg. timber harvests) or conservation measures occur. Proper planning with accurate, and legally and scientifically sound information will result in less conflict. Less time will be wasted, and less money spent, attempting to resolve endangered and threatened species issues.

Uses for the Landscape Project

The ENSP has developed maps that identify critical areas for imperiled species based on land-use classifications and imperiled species locations. The maps will enable state, county, municipal and private agencies to identify important habitats and protect them in a variety of ways:

- ◆ **Prioritize conservation acquisitions:** Critical area maps can be used to prioritize land parcels for purchase through acquisition programs such as Green Acres, Farmland Preservation and the US Fish and Wildlife Service's refuge system.

- ◆ **Guide regulators and planners:** Critical area maps provide land-use regulators and state, county and local planners with the tools they need to enhance protection through the regulatory and planning process.

- ◆ **Provide citizens with conservation tools:** The Landscape Project provides the tools to guide citizen actions to protect imperiled species habitat at the local level. By combining critical area maps with

and publicly owned lands, important areas in need of protection can be easily identified.

- ◆ **Guide stewardship of conserved areas:** New Jersey already has more than 400,000 hectares of open space. These lands are managed by a variety of agencies and organizations, both public and private. Critical area maps identify important imperiled species habitats on these lands. ENSP biologists work hand in hand with land managers and landowners to develop appropriate best management practices for the long-term conservation of imperiled species.

Who benefits

Protecting large expanses of fields, forests and wetlands helps to ensure that imperiled species will remain a part of New Jersey's future (**Figure 3**). In addition to providing habitat for the conservation of imperiled species, the Landscape Project will result in more open space for outdoor recreation, as well as public health and additional environmental benefits. Recent surveys by the US Fish and Wildlife Service show that more than 60% of Americans participate in some form of wildlife-related recreation. Open spaces provide places where people can escape the confines of urban and suburban living. Retaining habitats in their natural state provides other benefits such as reducing the threat of flooding, allowing for the biodegradation of environmental contaminants and recharging ground water reserves. In short, everyone benefits from the Landscape Project.



Figure 3. The Landscape Project aims to identify, delineate and ultimately protect critical areas for all New Jersey wildlife, including the bobcat, pictured above.

New Jersey's Landscape Regions

A landscape level perspective

Since animals require large expanses of natural habitat for their long-term survival (*Appendix I*), the Landscape Project focuses on large areas called Landscape Regions that are ecologically similar with regard to their plant and animal communities (*Figure 4*). Utilizing an extensive database that combines imperiled and priority wildlife location information with land-use/land-cover classification data, ENSP has identified and mapped critical areas for imperiled species within each Landscape Region. These landscape maps provide a highly accurate, reliable and scientifically sound basis for habitat protection within each landscape.

One of the Landscape Project's unique features is its focus on the big picture, and not just on individual locations of imperiled species as those areas become threatened. Thus, within large landscapes, the Landscape Project identifies critical wildlife areas that must be preserved now if we want to assure the conservation of New Jersey's imperiled wildlife for future generations.

Skylands Landscape

This landscape encompasses all of Sussex, Warren, Hunterdon, Passaic and Morris counties and parts of Somerset and Bergen counties. The region contains extensive tracts of contiguous upland and wetland forests that support diverse animal populations including red-shouldered hawks, goshawks, cerulean warblers, timber rattlesnakes and long-tailed salamanders. Bog turtles and great blue herons inhabit the extensive freshwater wetland systems found throughout the region.

Delaware Bay Landscape

This landscape encompasses all or parts of Cape May, Atlantic and Cumberland counties. This area features a stable population of bald eagles, tiger salamanders, southern gray tree frogs and 30 other endangered and threatened species. The vast woodland tracts of this region are among the largest in the state and support a large portion of New Jersey's Neotropical bird populations. The extensive saltwater marsh and sandy overwash beaches support a shorebird migration that has worldwide

ecological significance. Despite the heavy loss of habitat, the Cape May Peninsula remains one of the country's most important migratory "stopovers" for hundreds of bird and insect species.

Piedmont Plains Landscape

This landscape encompasses all or parts of Burlington, Gloucester, Mercer, Middlesex, Monmouth and Salem counties. It is dominated by the Delaware and Raritan rivers, and is characterized by farmed areas, extensive grasslands, fragmented woodlands and tidal freshwater marshes that are among the most productive in the world. Imperiled species within this landscape include grassland birds such as the endangered upland sandpiper, and woodland raptors such as the barred owl and Cooper's hawk.

Pinelands Landscape

This landscape encompasses all or parts of Atlantic, Ocean, Burlington, Camden and Gloucester counties. An internationally recognized ecosystem, the Pinelands supports extremely diverse reptile, amphibian and invertebrate populations including pine snakes, corn snakes, Pine Barrens treefrogs, Pine Barrens bluets, green darners and arogoos skippers. Extensive cedar swamps and wetland systems contain numerous insect species, as well as sustainable populations of many Neotropical birds. Its waterways support aquatic communities unique among the Mid-Atlantic states.

Atlantic Coastal Landscape

This landscape encompasses parts of Monmouth, Ocean and Atlantic counties. New Jersey's Atlantic Coast beaches and marshes are among the most productive coastal habitats in the country. Despite heavy development, they support important portions of Atlantic Coast populations of colonial nesting birds, such as common terns, little blue herons and great egrets, and endangered beach-nesting birds such as least terns and piping plovers. The coastal habitats also support most of the state's ospreys and peregrine falcons, as well as a large number of northern harriers.

New Jersey's Landscape Regions



Figure 4. *New Jersey's Landscape Regions.*

Landscape Project Mapping

Methodology for Identifying and Delineating Critical Wildlife Areas

Data

Land Use/Land Cover: The land-use/land-cover data that formed the basis of Version 1.0 of the Landscape Project was a raster-based classification developed by Rutgers University Center for Remote Sensing and Spatial Analysis (CRSSA). This dataset was based on Landsat Thematic Mapper imagery that was enhanced with other ancillary data such as US Fish and Wildlife Service wetland maps, New Jersey Department of Environmental Protection (DEP) freshwater wetland maps and Natural Resource Conservation Service county soil maps. ENSP selected CRSSA's raster-based dataset (CRSSA LC) over the DEP's vector-based land-use/land-cover dataset (LU/LC) primarily because it could be easily updated to reflect the rapidly changing habitat conditions within New Jersey. Changes in land use and land cover have a profound influence on wildlife habitat and ENSP biologists wanted the ability to update the Landscape maps on a frequent basis.

In Version 2.0, the ENSP opted to use the DEP's air photo-based land-use/land-cover data primarily because of the desire for consistency with other geographic data and mapping applications that employ these data across the department. The increased resolution of the aerial photo-based data and the commitment by the DEP to update the 1995 data with 2002 imagery provided additional rationale for using the NJDEP LU/LC data.

DEP's Division of Science, Research and Technology conducted a study with ENSP, other DEP programs (Bureau of Geographic Information Systems; Office of Natural Lands Management; and the Forest Service) and Rutgers CRSSA in which detailed analyses of five geographic data sets that characterize New Jersey's diverse landscape were compared (Lathrop and Hasse 2003). This research revealed several important differences between the NJDEP LU/LC and the CRSSA LC datasets.

Vector-based polygon data is represented by individual points and the line segments that connect

them. As a result, line segments can form irregular shapes of varying areas to accurately depict land features in detail. Raster layers are based on a regularly spaced grid with rectangular shaped cells. Since a cell can have only one value, classification involves calculating the land class that makes up the majority of the cell and assigning it that value. Since the cells cannot be divided the result is a jagged, less accurate border around each land-use type. Therefore, the vector-based data has the benefit of topological capabilities as well as database functionality that is better suited for regulation, planning and management applications (*Figure 5*).

In addition, the NJDEP LU/LC was created from visual photo-interpretation and therefore is able to use shape, pattern and context to accurately map land features in detail. The CRSSA LC uses spectral reflectance values to differentiate land covers. Many factors can influence the accuracy of this technique such as climatic conditions, seasonal variation and heterogeneity of spectral signatures for particular land covers.

The NJDEP LU/LC classifies land use and land cover by assigning one of 66 classes described in Anderson et al. (1976). CRSSA LC uses a classification that is based on the physical material covering the earth's surface. Consequently, some areas are classified differently by the two methods. For example, lawn areas in parks are classified by the NJDEP LU/LC as developed. CRSSA LC classifies the same area as grasslands. Due to these differences some of the LU/LC classes had to be modified to include known wildlife habitat (*Appendix II*).

Wetlands also are treated differently by the two systems and may result in different classifications for similar land types. For example, the NJDEP LU/LC classifies wet hayfields as wetlands due to their regulatory status, but CRSSA LC may classify the same area as grasslands.

Mapping resolution and precision of the NJDEP LU/LC maps is slightly improved in comparison to the CRSSA-derived maps, and the ENSP based its decision to use the NJDEP LU/LC on these factors. However, because some of the species models (eg. bald eagle foraging and colonial waterbird foraging) were developed for Version 1.0, they are calculated using raster-based data and then converted to a

vector-based polygon for inclusion in the Landscape Project.

For complete details on New Jersey 1995/97 Land Use/Land Cover Update Project consult the DEP's Web site at:

<http://www.nj.gov/dep/gis/supfiles.html>

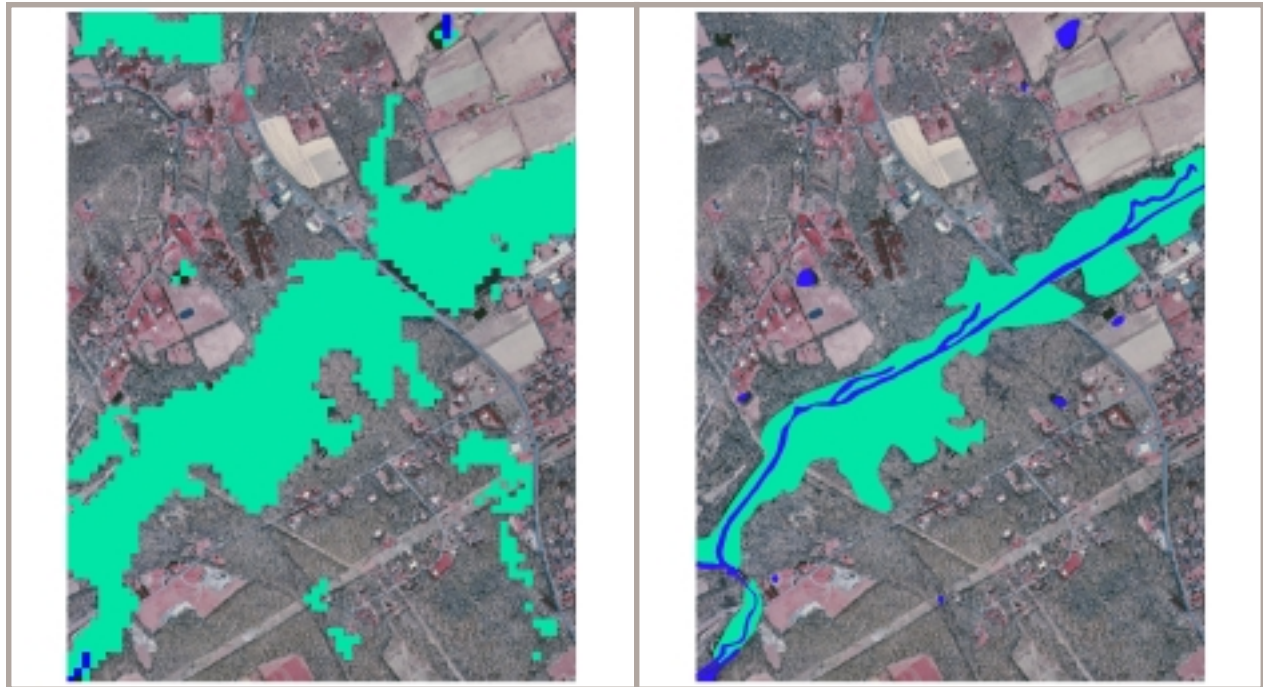


Figure 5. A comparison of raster-based data (left) versus vector-based data (right). Note the jagged boundary of the raster-based habitat polygon compared to the smooth boundary of the vector-based habitat polygon.

Species Data: Documented occurrences of imperiled species are used to determine critical areas. The majority of the species data used in the Landscape Project are taken directly from the Natural Heritage Program's (NHP) Biological Conservation Database (BCD) GIS coverage. Wildlife records in the BCD are derived from a variety of sources. These include ENSP surveys, DEP staff reports, private consultant reports and reports from the general public. ENSP staff is responsible for verifying all submitted records prior to acceptance (**Appendix III**). All verified sightings are mapped on 1:24000 USGS 7.5' topographic maps or the most recent color infrared aerial imagery by a staff biologist prior to entry into the BCD. Only seconds precision records (mapped to within one second of latitude and longitude) with a last observation date of 1970 or later are used to delineate and classify critical areas.

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Models are applied to all species data that are used to generate the Landscape Project critical area maps (**Appendix IV**). Some models were developed based on home range/territory sizes reported in the scientific literature. Other species models consist of polygons having an area equivalent to one second of latitude and longitude with the actual sighting location at the center, or a digitized polygon that represents the habitat used by the species as defined in the NHP's Element Occurrence Specification Standards.

General Methodology for Delineating Critical Areas

The method for delineating critical areas is relatively straightforward. First, the relevant classes for each habitat type (forest, grassland, forested wetland, emergent wetland and beach) are extracted from the NJDEP's LU/LC data layer. Dissolving the different LU/LC classes for each habitat type creates contiguous habitat polygons. Using boundaries between habitat types and major roads (county level 500 and above), contiguous patches for each habitat type are delineated. Each patch is then assigned a unique link ID. Imperiled species models are then intersected with habitat patches. Habitat patches are classified based on the status of the species present as follows (**Figure 9**):

- ◆ **Rank 5** is assigned to patches containing one or more occurrences of at least one wildlife species listed as endangered or threatened on the Federal list of endangered and threatened species.
- ◆ **Rank 4** is assigned to patches with one or more occurrences of at least one State endangered species.
- ◆ **Rank 3** is assigned to patches containing one or more occurrences of at least one State threatened species.
- ◆ **Rank 2** is assigned to patches containing one or more occurrences of at least one non-listed State priority species.
- ◆ **Rank 1** is assigned to patches that meet habitat-specific suitability requirements such as minimum size criteria for endangered, threatened or priority wildlife species, but that do not intersect with any confirmed occurrences of such species.

See **Figure 6** for a statewide distribution of habitat by landscape region and **Figure 7** for a statewide distribution of critical areas (rank 3,4,5) by landscape region.

Detailed Methodology for Delineating Critical Areas by Habitat Type

Forest: Critical area maps for forest-dependent species are generated by selecting specific land-use classes from the NJDEP's LU/LC data set. See **Appendix V** for a list of DEP land-use classes and the corresponding habitat types. Using GIS software, the ENSP has developed the following protocols (**Figure 8**):

Outside of the Pinelands

- ◆ Extract all appropriate forest types (upland and wetland forests) from the NJDEP LU/LC dataset into one forest layer (**Appendix IV**).
- ◆ Combine all of the NJDEP LU/LC forest types that are directly adjacent to one another by dissolving the boundaries between them making a layer of contiguous forest polygons.
- ◆ Bisect the resulting forest coverage using major roads (500 level and above) to create ecologically significant boundaries between contiguous forest patches.
- ◆ Clip the resulting forest coverage by the Pinelands Area Boundary of New Jersey.
- ◆ Identify these patches and sections of patches as Pinelands Area patches.

For Pinelands Area patches proceed to protocol under the subheading “Pinelands.” For forest patches outside of the Pinelands Area continue below:

- ◆ Identify forest patches that have a core area of 10 hectares or greater. Core area is defined as interior forest greater than 90 meters from the forest edge.
- ◆ Buffer all forest patches inward from the perimeter by 90 meters.
- ◆ Erase this buffer from each patch.
- ◆ If the sum of the remaining area is 10 hectares or greater, then the original patch is recoded as core. These patches receive a minimum rank of 1.

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- ◆ Combine the Pinelands Area patches and sections of patches with the remaining forest patches that are directly adjacent to one another by dissolving the boundaries between them making a layer of contiguous forest polygons.
- ◆ Assign each new patch a unique Link ID used for tracking patches.
- ◆ Intersect forest species models with the new forest layer. This intersection results in a new layer with the Link ID from the forest layer and an ID from the species models. From this layer queries can be made to determine the number of records and conservation status of each patch based on the species present.
- ◆ All forest patches in the Coastal Landscape Region and the lower 10 kilometers of the Cape May peninsula are considered critical areas due to the importance of these habitats to migrating birds. These patches receive a minimum rank of 1 regardless of whether or not they contain 10 hectares of core forest.
- ◆ Habitat patches are classified based on the conservation status of the species present as detailed in the “General Methodology for Delineating Critical Areas,” section.

Pinelands

- ◆ Identify Pinelands Area connection corridors. Pinelands Area patches connected by any corridor that is greater than 91.44 meters in length and less than 91.44 meters wide are considered separate patches.
- ◆ Buffer all forest patches inward from the perimeter by 45.73 meters. This action eliminates all Pinelands connecting corridors that do not meet the required dimensions.
- ◆ Pinelands Area patches that meet the required dimensions are buffered outward from the perimeter by 45.73 meters and merged with any overlapping forest polygons. This buffer brings the forest patch back out to its original extent minus Pinelands connection corridors that do not meet the required dimensions.
- ◆ Identify Pinelands Area patches that have a core area of 10 hectares or greater. Pinelands core area is defined as contiguous interior forest greater than 90 meters from the forest edge.
- ◆ Buffer all forest patches inward from the perimeter by 90 meters.
- ◆ Erase this buffer from each patch.
- ◆ If a contiguous section of the remaining area is 10 hectares or greater, then the original patch is re-coded as core and receives a minimum rank of 1.
- ◆ Combine the Pinelands Area patches and sections of patches with the remaining forest patches that are directly adjacent to one another by dissolving the boundaries between them making a layer of contiguous forest polygons.
- ◆ Assign each new patch a unique Link ID used for tracking patches.
- ◆ Intersect forest species models with the new forest layer. This intersection results in a new layer with the Link ID from the forest layer and an ID from the species models. From this layer queries can be made to determine the number of records and conservation status of each patch based on the species present.
- ◆ All forest patches in the Coastal Landscape Region and the lower 10 kilometers of the Cape May peninsula are considered critical areas due to the importance of these habitats to migrating birds. These patches receive a minimum rank of 1 regardless of whether or not they contain 10 hectares of core forest.
- ◆ Habitat patches are classified based on the conservation status of the species present as detailed in the “General Methodology for Delineating Critical Areas,” section.

Hectares of Critical Area by Landscape Region (percentage of total land area within each region)

Skylands Region

Emergent Wetland	14608	(3%)
Forested Wetland	42777	(8%)
Forest*	252544	(47%)
Grassland	91248	(17%)
Beach/Dune	3	(<1%)

Piedmont Plains Region

Emergent Wetland	40949	(6%)
Forested Wetland	74912	(11%)
Forest*	107831	(15%)
Grassland	116517	(17%)
Beach/Dune	439	(<1%)

Pinelands Region

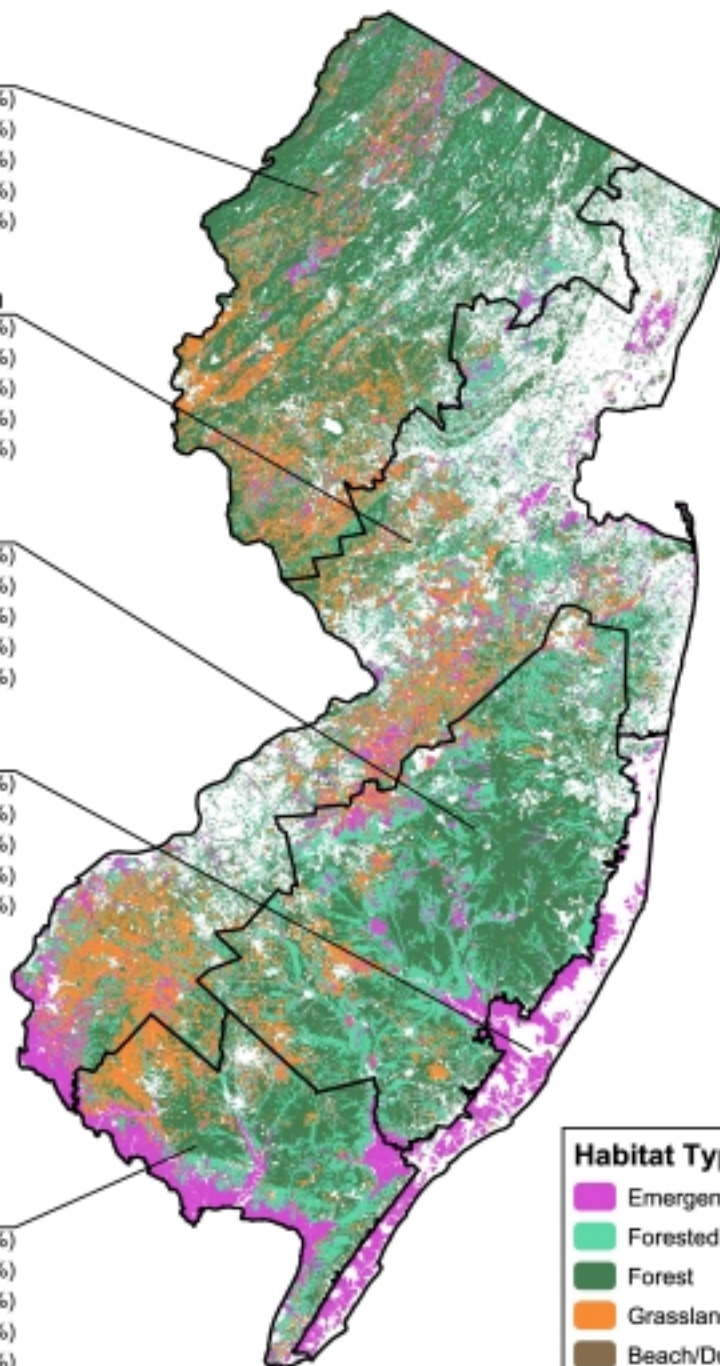
Emergent Wetland	18269	(4%)
Forested Wetland	107415	(23%)
Forest*	211127	(45%)
Grassland	35782	(8%)
Beach/Dune	115	(<1%)

Coastal Region

Emergent Wetland	36384	(35%)
Forested Wetland	1596	(2%)
Forest*	919	(1%)
Grassland	121	(<1%)
Beach/Dune	1346	(1%)

Delaware Bay Region

Emergent Wetland	33897	(17%)
Forested Wetland	35780	(18%)
Forest*	66106	(33%)
Grassland	28798	(14%)
Beach/Dune	314	(<1%)



Habitat Type

■	Emergent Wetland
■	Forested Wetland
■	Forest
■	Grassland
■	Beach/Dune

*Due to overlap of Forest and Forested Wetland layers, Forest hectares and percentages were calculated excluding area where overlap occurs.

Figure 6. Hectares of each habitat type expressed as a percentage of the total land area within each Landscape Region.

Hectares of Critical Area Valued for Imperiled Species by Landscape Region (percentage of total land area within each region)

Skylands Region

Emergent Wetland	2797	(1%)
Forested Wetland	22807	(4%)
Forest*	225728	(42%)
Grassland	28183	(5%)
Beach	0	(0%)

Piedmont Plains Region

Emergent Wetland	11797	(2%)
Forested Wetland	11259	(2%)
Forest*	37563	(5%)
Grassland	21117	(3%)
Beach	209	(<1%)

Pinelands Region

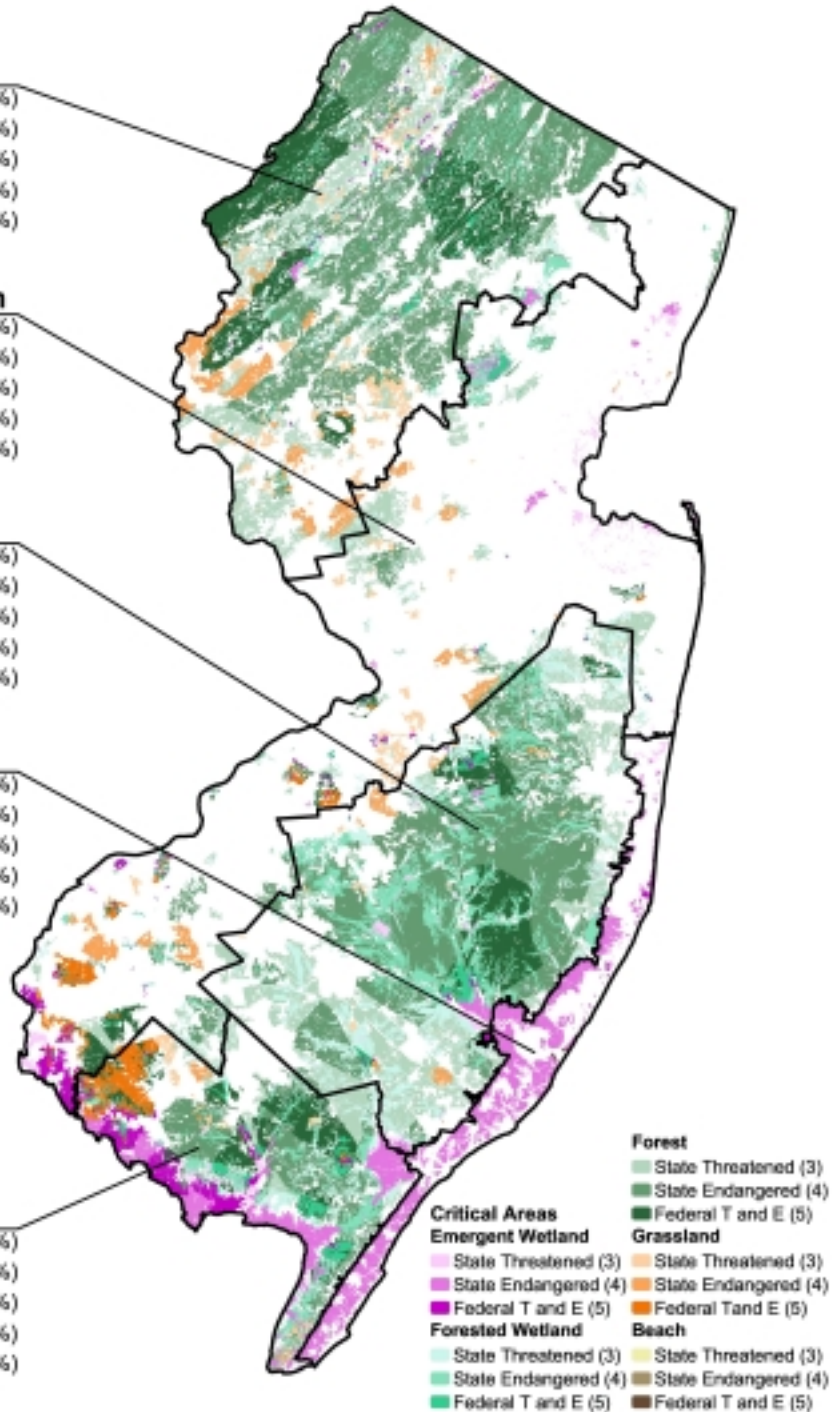
Emergent Wetland	5411	(1%)
Forested Wetland	79388	(17%)
Forest*	206906	(44%)
Grassland	4477	(1%)
Beach	108	(<1%)

Coastal Region

Emergent Wetland	36284	(35%)
Forested Wetland	304	(<1%)
Forest*	242	(<1%)
Grassland	12	(<1%)
Beach	706	(1%)

Delaware Bay Region

Emergent Wetland	30349	(15%)
Forested Wetland	27760	(14%)
Forest*	61841	(31%)
Grassland	14384	(7%)
Beach	265	(<1%)



*Due to overlap of Forest and Forested Wetland layers, Forest hectares and percentages were calculated excluding area where overlap occurs.

Figure 7. Total hectares of critical area by habitat type within each Landscape Region.

Forested Wetland: Critical area maps for forested wetland dependent species are generated by selecting specific land-use classes from the NJDEP's LU/LC data set. See **Appendix V** for a list of DEP land-use classes and the corresponding habitat types. Using GIS software, the ENSP has developed the following protocol:

- ◆ Extract all appropriate forested wetland types from the NJDEP's LU/LC data set into one forested wetland layer (**Appendix V**).
- ◆ Combine all of the NJDEP LU/LC forested wetland types that are directly adjacent to one another by dissolving the boundaries between them making a layer of contiguous forested wetland polygons.
- ◆ Bisect the resulting forested wetland coverage with major roads (500 level and above) to create ecologically significant boundaries between contiguous forested wetland patches.
- ◆ Assign each new patch a unique Link ID used for tracking patches.
- ◆ All forested wetland patches are considered critical areas regardless of size. Therefore, all forested wetland patches receive a minimum rank of 1.
- ◆ Intersect forested wetland species models with the new forested wetland layer. This intersection results in a new layer with the Link ID from the forested wetland layer and an ID from the species models. From this layer queries can be made to determine the number of records and conservation status of each patch based on the species present.
- ◆ Habitat patches are classified based on the conservation status of the species present as detailed in the "General Methodology for Delineating Critical Areas," section.

Emergent wetland: Critical area maps for emergent wetland dependent species are generated by selecting specific land-use classes from the NJDEP's LU/LC data set. See **Appendix V** for a list of DEP land-use classes and the corresponding habitat types. Using GIS software, the ENSP has developed the following protocol:

- ◆ Extract all appropriate emergent wetland types from the NJDEP's LU/LC land-use/land-cover data set into one emergent wetland layer (**Appendix V**).
- ◆ Combine all of the NJDEP LU/LC emergent wetland types that are directly adjacent to one another by dissolving the boundaries between them making a layer of contiguous emergent wetland polygons.
- ◆ Bisect the resulting emergent wetland coverage with major roads (500 level and above) to create ecologically significant boundaries between contiguous emergent wetland patches.
- ◆ Assign each new patch a unique Link ID used for tracking patches.
- ◆ All emergent wetland patches are considered critical areas regardless of size. Therefore, all emergent wetland patches receive a minimum rank of 1.
- ◆ Intersect emergent species models with the new emergent wetland layer. This intersection results in a new layer with the Link ID from the emergent wetland layer and an ID from the species models. From this layer queries can be made to determine the number of records and conservation status of each patch based on the species present.
- ◆ Habitat patches are classified based on the conservation status of the species present as detailed in the "General Methodology for Delineating Critical Areas," section.

Grassland: Critical area maps for grassland dependent species are generated by selecting specific land-use classes from the NJDEP's LU/LC data set. See **Appendix V** for a list of DEP land-use classes and the corresponding habitat types. Using GIS software, the ENSP has developed the following protocol :

- ◆ Extract all appropriate grassland habitat types from the NJDEP's LU/LC data set into one grassland layer (**Appendix V**).
- ◆ Combine all of the NJDEP LU/LC grassland types that are directly adjacent to one another by dissolving the boundaries between them making a layer of contiguous grassland polygons.

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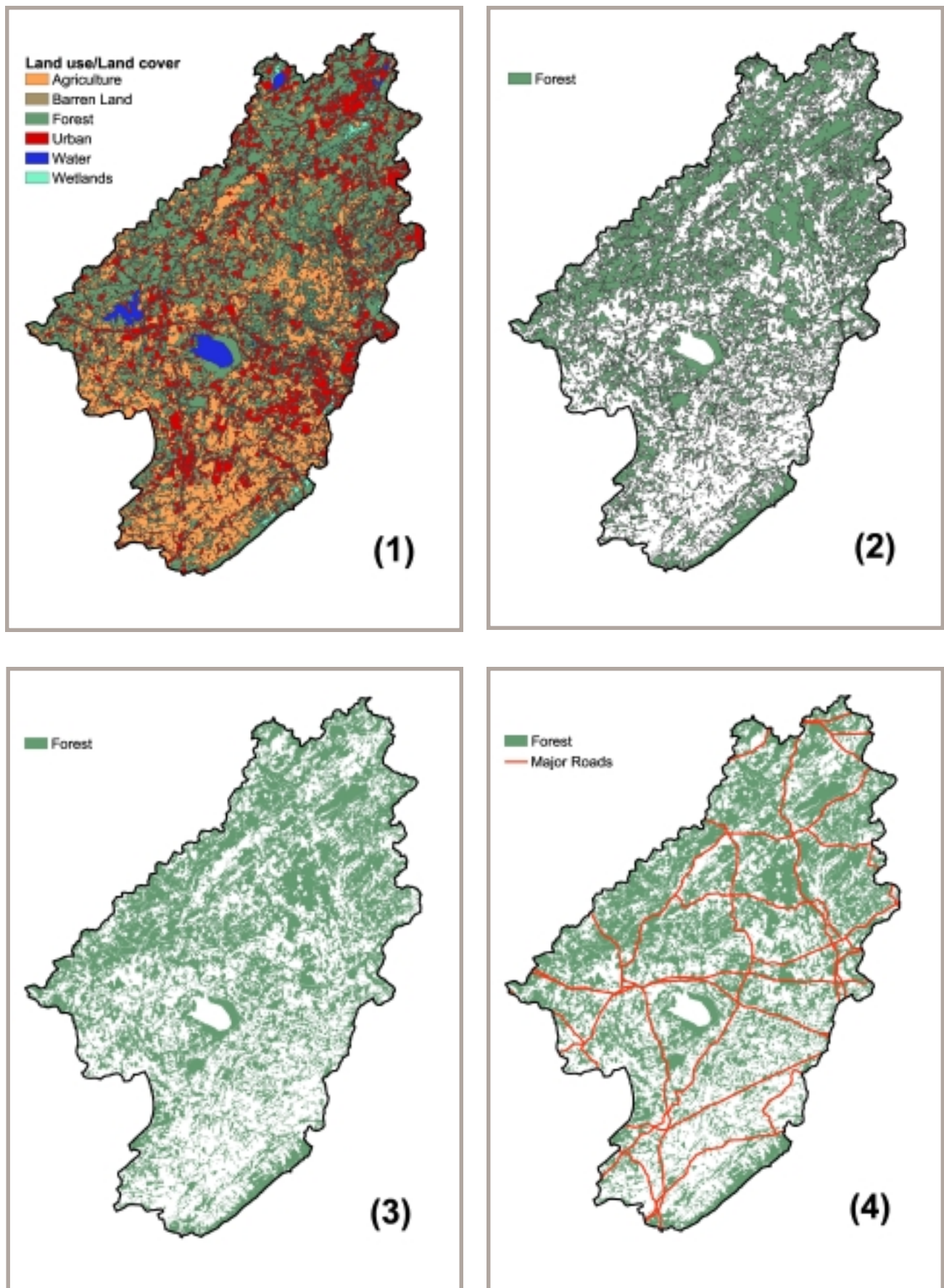


Figure 8. A multistep process is used to delineate critical forest areas in North and South Branch Raritan Watershed Management Area. (1) NJDEP's 1995/1997 land-use/land-cover types. (2) Extract all forest types from the land-use/land-cover data. (3) Contiguous patches are created by dissolving boundaries between adjacent forest polygons. (4) Critical forest patches using major roads to create ecologically significant boundaries.

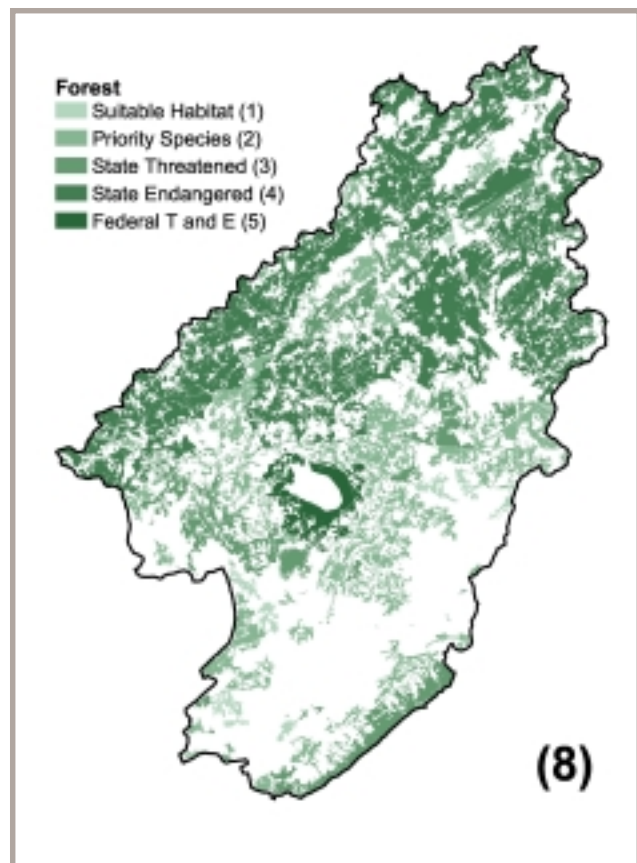
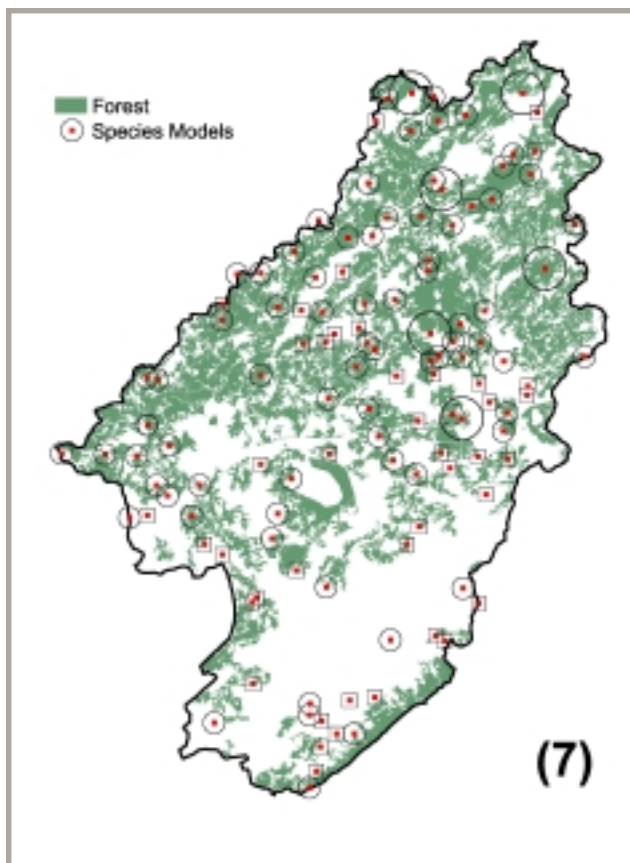
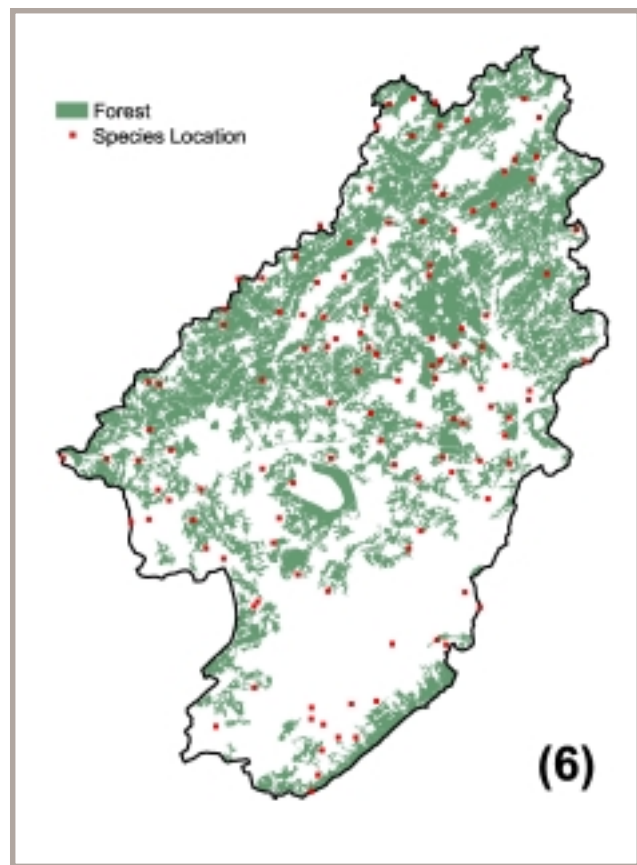
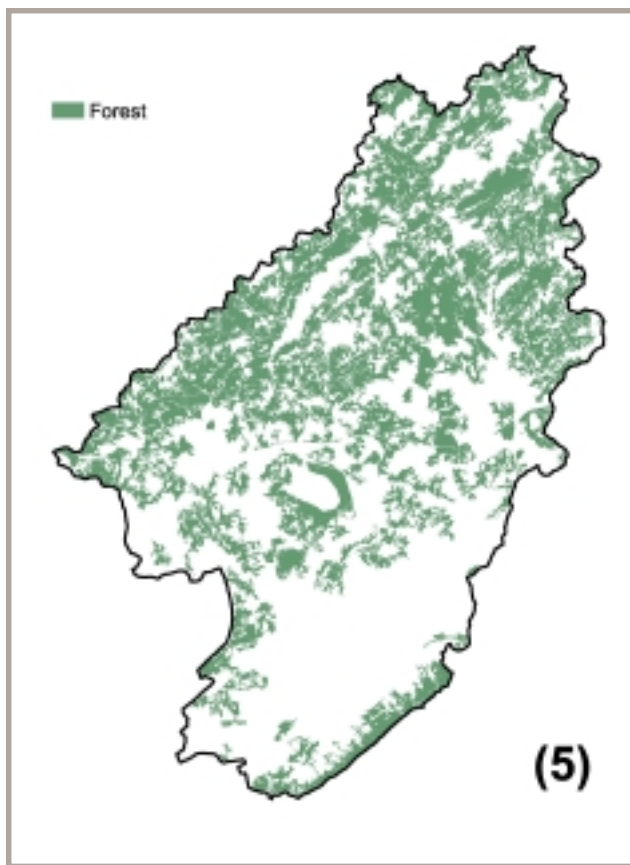


Figure 8 (Cont.). (5) Select forest patches meeting the minimum core size. (6) Overlay species point locations on the forest coverage. (7) Intersect species models with the forest patches. (8) Rank habitat patches based on the conservation status of species present.

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- ◆ Bisect the resulting grassland coverage with major roads (500 level and above) to create ecologically significant boundaries between contiguous grassland patches.
- ◆ Assign each new patch a unique Link ID used for tracking patches.
- ◆ Select all grassland patches greater than 18 hectares. These patches meet the minimum size requirement for grasslands and receive a minimum rank of 1.
- ◆ All grassland patches in the lower 10 kilometers of the Cape May peninsula are considered critical areas. This is due to the importance of this habitat to migrating birds. These patches receive a minimum rank of 1 regardless of whether or not they contain 18 hectares of core.
- ◆ Intersect grassland species models with the new grassland layer. This intersection results in a new layer with the Link ID from the grassland layer and an ID from the species models. From this layer queries can be made to determine the number of records and conservation status of each patch based on the species present.
- ◆ Habitat patches are classified based on the conservation status of the species present as detailed in the “General Methodology for Delineating Critical Areas,” section.

Beach: Critical area maps for beach dependent species are generated by selecting specific land-use classes from the NJDEP’s LU/LC data set. See **Appendix V** for a list of DEP land-use classes and the corresponding habitat types. Using GIS software, the ENSP has developed the following protocol :

- ◆ Extract the beach habitat type from the NJDEP’s LU/LC data set. Only one beach class exists in the data set (**Appendix V**).
- ◆ Beach habitats are bisected by natural breaks such as inlets and rivers and by hand digitized boundaries around species locations.
- ◆ Assign each new patch a unique Link ID used for tracking patches.
- ◆ All beach patches are considered critical areas regardless of size. Therefore, all beach patches receive a minimum rank of 1.
- ◆ Intersect beach species models with the new beach layer. This intersection results in a new layer with the Link ID from the beach layer and an ID from the species models. From this layer queries can be made to determine the number of records and conservation status of each patch based on the species present.
- ◆ Habitat patches are classified based on the conservation status of the species present as detailed in the “General Methodology for Delineating Critical Areas,” section.

Detailed Methodology for Delineating Critical Areas by Special Habitat Requirements

For some species, additional specific mapping protocols were developed and are set forth below.

Bald Eagle Foraging Area: All known bald eagle nests are recorded using GPS equipment. To run the model, all water polygons from the DEP LU/LC having an area greater than 8 hectares are converted to a 5-meter grid. A radius around the nest site is incrementally increased, one cell (5 meters) at a time, until an area of 660 hectares of open water has been identified. All emergent wetland patches within 90 meters of the identified water are selected. The emergent wetland patches are merged with the

identified open water. A 90-meter buffer is applied to the combined water/emergent wetland layer to protect perching sites. In the previous version (1.0) all habitat patches that intersected with the foraging habitat and 90-meter buffer were designated as critical areas. In Version 2.0 bald eagle foraging habitat, and its associated 90-meter buffer, is no longer used to value patches that intersect with it. The bald eagle foraging model is a stand-alone GIS layer that is not used to value habitat patches.

Peregrine Falcon: In Version 1.0 of the Landscape Project, emergent wetland patches that intersected a

1-kilometer radius area delineated around a peregrine falcon nest were valued as peregrine falcon habitat.

In Version 2.0, peregrine falcon nests are separated into two types, urban and non urban depending on the type of landscape in which they are located. For urban nests a 1-kilometer radius area around the nest is now valued as peregrine falcon habitat regardless of the land-cover type. Urban peregrine nests continue to value emergent wetland patches that intersect with the 1-kilometer radius area delineated around a peregrine falcon nest. Non-urban peregrine falcon nests continue to value only emergent wetland patches that intersect with the 1-kilometer radius area around the nest. The urban peregrine falcon model is a stand-alone GIS layer that values emergent wetland habitat patches.

Wood Turtle: Critical areas for wood turtles are mapped following a four-step process.

A 1.6-kilometer radius is placed around each wood turtle sighting location in the BCD. A 322-meter buffer is then applied to all streams that fall within the 1.6-kilometer radius. The NJDEP LU/LC is then overlaid on the buffered areas and all areas classified as urban, with the exception of powerline rights-of-way, are deleted from the buffer. DEP Freshwater Wetland Maps are overlaid on the stream buffers, and all wetlands that intersect the buffer are clipped within the 1.6-kilometer radius and are merged into the stream/buffer polygon. The final step of the process involves a detailed quality-control check and revision of each polygon to ensure biological accuracy. The wood turtle model is a stand-alone layer that is not used to value habitat patches.

The two principal differences between Version 1.0 and 2.0 are as follows: In Version 2.0, streams classified as 1st order or greater are included, while in Version 1.0 only streams classified by DEP as 2nd order and greater were included. This change was made based upon additional analysis following release of Version 1.0 that revealed a large number of documented wood turtle occurrences were on DEP 1st order streams, which were suitable for wood turtles.

In Version 2.0, only the identified wetlands together with the streams and stream buffers constitute wood

turtle habitat, while in Version 1.0 any patches of upland forest, forested wetland, emergent wetland and grassland that intersected with the wetland and stream buffers were valued as wood turtle habitat. This change was made to limit the delineated habitat to those areas closest to suitable streams because the approach used in Version 1.0 included areas too distant from streams to be considered suitable for wood turtles. As a result of applying both of these changes, Version 2.0 values significantly less area as wood turtle habitat than Version 1.0.

Technical Information

Critical area maps are in ArcView shapefile format and projected to NJ State Plane feet, datum NAD 83, zone 4701. The maps are best viewed using ArcView 3.x or ArcGIS 8.x. These software products allow the user full functionality for viewing and manipulating critical area data. Non-GIS users can view the maps using ArcExplorer, a free GIS data browser that can be downloaded from the ESRI Web site (<http://www.esri.com/software/arcexplorer/aedownload.html>). ArcExplorer allows the user to view GIS data, zoom in and out, perform simple queries and print maps.

How to get critical area maps: Landscape Project data is available via download or viewing from the following DEP Web sites:

- ◆ <http://www.nj.gov/dep/fgw/ensp/landscape/index.htm>
- ◆ www.njfishandwildlife.com
- ◆ Interactive i-MapNJ Web site: <http://www.state.nj.us/dep/gis/imapnj/imapnj.htm>

or by contacting:

New Jersey's Landscape Project
Department of Environmental Protection
Division of Fish and Wildlife
Endangered and Nongame Species Program
PO Box 400
Trenton, NJ 08625-0400
Phone:(609) 292-9400
Fax:(609) 984-1414

New Jersey's Critical Wildlife Areas

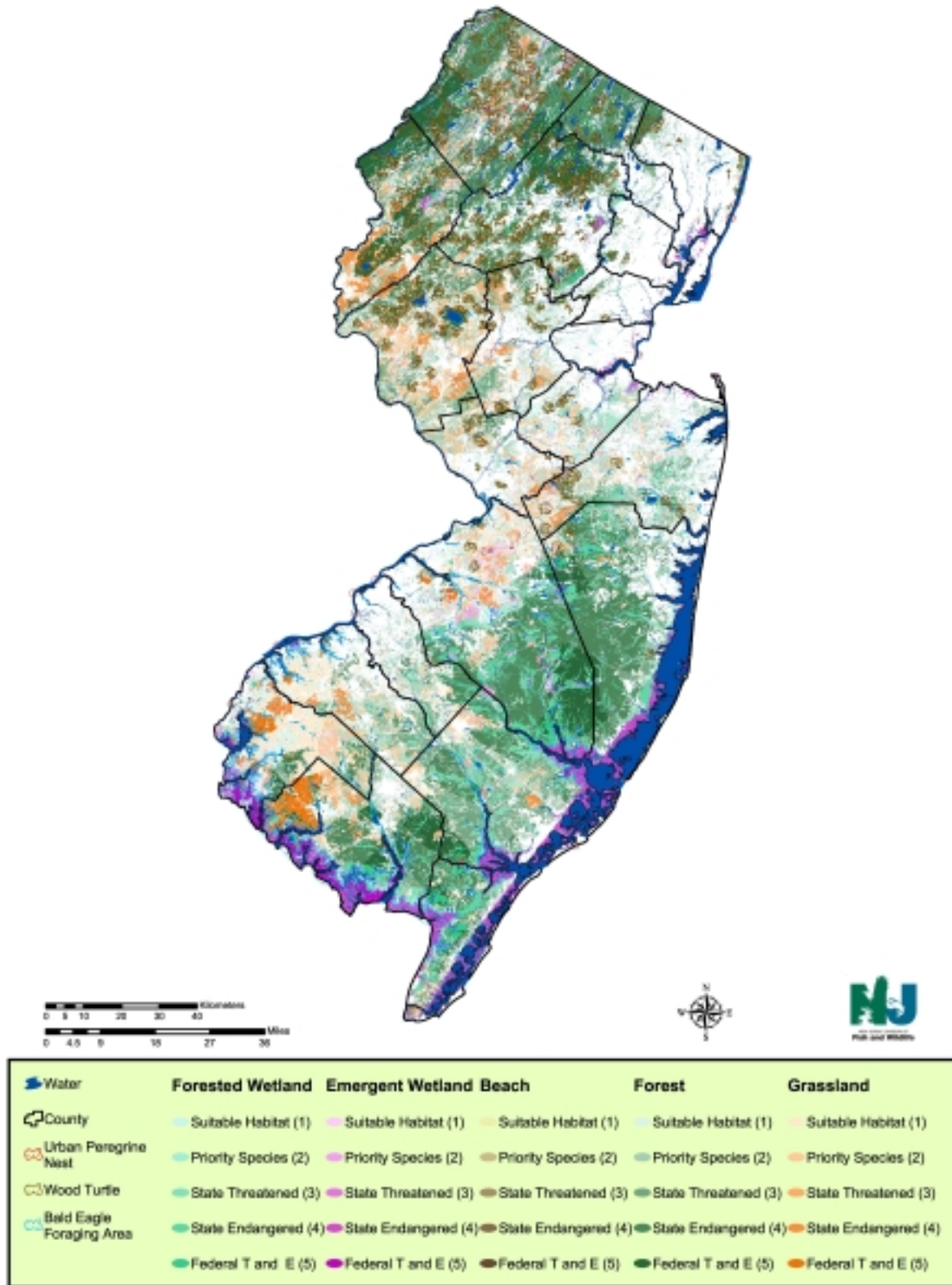


Figure 9. New Jersey's critical wildlife areas are color coded based on habitat type (forest, forested wetland, emergent wetland, grassland and beach), with lighter to darker shades depicting the rank of patches.

Appendices.

Appendix I. Habitat Fragmentation and Area Sensitivity

Definitions:

Priority species- means nongame species that are considered by the DEP to be species of special concern as determined by a panel of experts. The term also includes species of regional concern in regional conservation plans such as Partners in Flight Bird Conservation Plans, North American Waterbird Conservation Plan, United States Shorebird Conservation Plan, etc.

Habitat Fragmentation- the process of converting a large, continuous patch of a similar vegetation type into smaller patches of different vegetation types in a way that only scattered remnants of the original vegetation type remains (Faaborg et al. 1995).

Forest-interior birds

Many of the bird species of special or regional concern are forest-interior birds, that is, birds that nest within the interior core of a forest patch (area of forest greater than 90 meters from an edge) (Faaborg et al. 1995). Many forest-interior species are Neotropical migrants that breed in temperate North America and overwinter in the tropics of Central and South America (the “New World” or “Neotropics”). Many resident and short-distance migrant species also require forest interior to breed successfully. Forest-interior birds, as a group, are declining because of loss and fragmentation of forested breeding habitat in North America (from urban sprawl) and wintering habitat in South America; the majority are area sensitive and negatively impacted by forest fragmentation (Table 1). When a forest is fragmented, the abundance of avian and mammalian predators often increases, as well as the frequency of brood parasitism, both of which result in lower nesting success. Forest fragmentation also facilitates the spread of exotic and invasive species, both vegetative and mammalian, that can dramatically change the habitat structure of the forest, affecting the abundance and availability of food and nest sites (DeCalesta 1994, Burke and Nol 1998, McCollin 1998, Hansen et al. 2002).

Grassland Birds

Grassland birds, which are mainly short-distance migrants, have experienced severe population declines throughout the United States and constitute a sizeable proportion of birds listed as special or regional concern. The decline of agriculture, change to mechanized agriculture, and introduction of cool-season grasses in the Northeast have resulted in a fundamental shift in the character of grassland habitats. Loss and conversion of agricultural habitats to development has fragmented farmland into small, isolated patches that cannot support grassland-dependent birds (Bollinger and Gavin 1992). Furthermore, mechanized agriculture with frequent early mowing causes direct mortality to adult and juvenile birds, and row-crop agriculture does not produce suitable breeding and foraging habitat for most grassland species.

Area Sensitivity

Neotropical migrant birds as a group, and species that prefer forest-interior habitat, tend to be more area sensitive (Whitcomb et al. 1981). In their literature review, Mitchell et al. (2000) found clear documentation of the area sensitivity of more than nine grassland bird species.

Area-sensitive species require a minimum amount of interior, or “core”, habitat for successful breeding, and this minimum can vary depending on the habitats in the surrounding matrix. For grassland species, core habitat is the grassland habitat at least 50 meters inward from the grassland edge. For forest species, core habitat is the forest habitat at least 90 meters inward from the forest edge. The minimum core required to provide suitable breeding habitat for area-sensitive species is 10 hectares of forest core and 18 - 50 hectares of grassland core, (Dawson et al. 1993, Franklin 1993, Vickery et al. 1994, Faaborg et al. 1995, Collinge 1996, Dawson et al. 1998). The minimum area required to support breeding of one of the least area-sensitive grassland species (savannah sparrow) is 10 ha. of core habitat, whereas upland sandpipers require habitat in the range of 200 ha. to support a breeding population (Vickery et al. 1994). Area-sensitive birds tend

not to occur in forests and grasslands, respectively, that lack core habitat (McCollin 1998, Forman et al. 2002).

The creation of “edge” habitat, resulting from fragmentation of a forest patch, changes the micro-habitat of that edge zone so that it is different from the neighboring forest some distance into the interior (Saunders et al. 1991, Murcia 1995, Collinge 1996). More sunlight and wind reach the edge of a forest, thus increasing the local temperature, decreasing humidity, and affecting the local plant community with an increase in invasive exotic species (Murcia 1995, Collinge 1996, Primack 1998). This change in the local climate also can increase the chance of fire (Faaborg et al. 1995, Primack 1998) and adversely affect nesting success and food availability in the forest patch (Burke and Nol 1998, McCollin 1998).

Many forest-interior bird species tend to avoid nesting in forest edges (Hoover et al. 1995, Collinge 1996, McCollin 1998, Miller et al. 1998, Villard et al. 1999, Forman et al. 2002). The presence of a forest edge introduces more generalist species to the area that compete for foraging and nest sites. A forest edge provides favorable conditions for mammalian and avian predators to increase in number and type (Hoover et al. 1995, Murcia 1995, Collinge 1996, McCollin 1998, Faaborg et al. 2002). The number of brown-headed cowbirds (a brood parasite) also increases in forest edges, further reducing nesting success of forest birds (Brittingham & Temple 1983, Robinson et al. 1995, Collinge 1996, McCollin 1998, Primack 1998). Kilgo et al. (1998) found the probability of occurrence of prothonotary warblers, northern parulas, white-eyed vireos, kentucky warblers, and yellow-billed cuckoos to significantly increase ($P < 0.05$) with core area. Of these species, the yellow-billed cuckoo and prothonotary warbler were the most sensitive to the amount of core habitat. Villard et al. (1999) found that the hairy woodpecker, least flycatcher, and veery are unlikely to occur in areas with increased edge.

In addition to habitat selection and overall productivity of bird species, the size of a habitat patch affects richness and abundance of species (Forman and Godron 1981, Robbins et al. 1989, Askins et al. 1990, Murcia 1995, Collinge 1996, Golden and Crist 2000, Summerville and Crist 2001). As the degree of forest fragmentation increases, and forest patches become smaller and more isolated, fewer area-sensitive species are present (low species richness). As a result, species assemblages become more unstable, with different species moving in and out of the patch over time (high turnover rate) (Cody 1985, Rosenzweig 1985, Askins et al. 1990, Primack 1998). Area-sensitive individuals attempting to breed in forest fragments begin to experience poor reproductive success and do not return in subsequent years (low site fidelity) (Donovan et al. 1995). Instability in the forest-interior breeding bird community and high turnover of breeding individuals is indicative of a population sink – a marginal habitat where reproductive success is low because of high nest depredation, brood parasitism, lack of adequate nest sites, poor prey availability, or a combination of these factors (Howe 1984, Wilcove 1985, Donovan et al. 1995, Burke and Nol 1998, Primack 1998, Boulinier et al. 2001).

Factors influencing effects of forest fragmentation and area sensitivity

There are many factors that influence the effects of forest fragmentation. When assessing the impacts of forest fragmentation from a landscape perspective, we need to look at the size and number of habitat patches left in the area, how far apart these patches are from each other (degree of isolation), how different the surrounding area (matrix) is from the habitat type, the type and duration of disturbance, and whether there is any type of connectivity or corridor between patches to facilitate animals moving from patch to patch (Wiens 1996, Marzluff and Ewing 2001).

A population that moves between and among patches of habitat via dispersal is called a metapopulation, or a “population of populations” (Forman 1995, Wiens 1996). It may include source populations, which have stable or positive population growth, and sink populations, which are unstable and dependent upon immigration of individu-

als from source populations for long-term persistence (Primack 1998). Generally, small, isolated forest patches tend to operate as sinks because they have a greater relative proportion of forest edge and little or no core area, which diminishes their ability to support viable populations of area-sensitive species. For birds, the result of habitat fragmentation is an increase in nest predators and brood parasitism, thus decreasing nesting success (Donovan et al. 1995). Large patches of contiguous forest usually act as sources, producing a surplus of individuals from high rates of reproductive success (Donovan et al. 1995). If a source habitat is fragmented, however, reproductive success drops, as does the tendency of the individuals to return to that habitat in subsequent years (Donovan et al. 1995). The results of this impact of fragmentation will not only affect the population in that source habitat, but it also will negatively affect populations in the surrounding sink habitats, as the surplus usually disperses to the neighboring sinks (Donovan et al. 1995).

Immigration and recolonization are critical for long-term, regional survival of local populations, particularly for endangered species. Imperiled species tend to have specific habitat requirements for foraging, nesting and cover (e.g., habitat “specialists”), making them more vulnerable to changes in the landscape. As it is, loss of habitat is the primary cause of the decline in species, affecting 85% of the species of plants, mammals, birds, reptiles, amphibians, fish, and invertebrates, followed by the increase of non-native species (Wilcove et al. 1998). When their habitats are lost or degraded because of fragmentation, individuals of the species also are lost because they cannot utilize habitats other than that which they are specialized for (With and Crist 1995, Collinge 1996). Furthermore, endangered species exist in much lower numbers, so it is critical that areas of suitable habitat are proximate, or connected, and the area of the habitat increased, if possible. This allows individuals to migrate to other sub populations, or into new areas of suitable habitat, while avoiding predators and hostile environments (e.g., roads, development) (Fahrig and Merriam 1985). Connectivity is particularly important for non vagile species (reptiles, amphibians, small mammals and some invertebrates) and large mammals with expansive home ranges, like bobcats (Collinge 1996, Wiens 1996).

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Degree of isolation and patch connectivity. For Neotropical migrants, many factors influence how the degree of isolation of habitat patches affect metapopulations; e.g., how long the patches have been separated, how far apart the patches are from each other, how connected the patches are to each other, how different the surrounding matrix is from the habitat, how the species in question is able to disperse (Saunders et al. 1991, Collinge 1996, Bender et al. 1998, McCollin 1998) and the degree of breeding site fidelity. In general, larger forest patches that are closer together are better for the population and patches within 500 meters of each other are beneficial (Villard et al. 1999, Norris and Stutchbury 2001).

Isolated habitat patches, those that are not in close proximity or connected to patches of similar habitat, can present barriers to dispersal because of large distances to suitable habitats and/or impenetrable areas surrounding the patches of suitable habitat (Moilanen & Hanski 1998, Ricketts & Morris 2001, Vandermeer & Carvajal 2001). Isolated habitat patches tend to have a higher turnover rate for bird species than connected habitat patches (Schmiegelow et al. 1997), with fewer Neotropical migrant species occurring in more isolated forest patches (Faaborg et al. 1995).

Mammalian responses to fragmentation differs with body size, but overall, mammals are affected by habitat fragmentation and isolation (Crooks 2002). Bobcats have a home range of approximately 3 kilometers² (Crooks 2002) and can be found in habitat patches of 74 hectares, if in close proximity to other forest patches, but more likely in areas over 1,000 hectares. However, smaller carnivores, such as foxes, skunks, raccoons, opossums and domestic cats, have a home range size around 0.5 kilometers², and tend to occur in highly fragmented areas created by urban sprawl (Crooks 2002).

The effects of patch size and isolation on a population also depend largely on the amount of available habitat, the suitability of the surrounding matrix, how individuals move within and among patches (Forman and Godron 1981, Andren 1994, Wiens et al. 1997) and the degree of breeding-site fidelity of the species. Depending on the species, the effects of patch isolation may not occur until 10-50% of the original habitat remains. However, the critical

threshold of habitat loss where negative effects will become apparent is difficult to predict and varies for different species (With and Crist 1995). For interior-forest birds specifically, the number of species occurring in a forest patch is significantly reduced when 30-50% of the patch is removed (Franklin and Forman 1987). Habitat specialists are affected when less than 40% of the habitat remains, whereas habitat generalists, (those species that tend to persist in a highly fragmented landscape), can withstand a higher degree of habitat loss (With and Crist 1995). Northern spotted owls are area-sensitive habitat specialists, occurring only in large forest tracts of mature coniferous forest in the Pacific Northwest. Lamberson (1994) found that as the amount of habitat decreased, juvenile owls had more difficulty finding suitable habitat while dispersing, regardless of spacing of habitat patches. The breeding pairs exhibited high site fidelity and still produced young in the waning habitat. However, their offspring dispersed into the surrounding matrix, which was unsuitable habitat, and experienced high rates of mortality. The “point-of-no-return” for habitat loss with spotted owls was with less than 15% of suitable habitat remaining in the landscape. At this point there was virtually no probability of owls finding mates or suitable nesting sites, and the population of spotted owls in that landscape would soon be extirpated (Lamberson et al. 1994).

It is important to preserve and maintain large tracts of habitat for the most area-sensitive species. In landscapes where at least 30-40% of the habitat remains, spatial arrangement (proximity and connectivity) of habitat patches also can be very important (Franklin and Forman 1987, Andren 1994, With and Crist 1995, Forman and Collinge 1997, Fahrig 1998), as each species has its own threshold tolerance for habitat loss and fragmentation (Lovejoy and Oren 1981, Monkkonen and Reunanen 1999). There are, however, some species, such as the American marten, that are affected by habitat loss regardless of connectivity (Hargis 1999).

Ability to disperse. For birds and other animals that are very mobile, the effects of isolation on a population may only appear in very fragmented habitats (Andren 1994, With and Crist 1995). Birds are physically capable of dispersing over great distances

and through various habitats during migration, which allows them to locate scarce patches of foraging and resting habitat. However, open areas within large patches of forest may act as a barrier to forest-interior species (Belisle and St. Clair 2001). Furthermore, larger distances between patches (>2.4 km) can hinder dispersal and re-colonization of patches during breeding (Bellamy et al. 1996).

Limited dispersal capabilities for non vagile animals (small mammals, reptiles, amphibians, invertebrates) make these species more sensitive to habitat fragmentation (Collinge 1996, Wiens 1996). The degree of isolation can be a more serious problem where the matrix may be a complete barrier to dispersal, cause direct mortality (roads and highways), or severely reduce the likelihood of survival during immigration through this matrix (Noss 1991). Barriers to immigration and emigration result in inbreeding depression from reduction in gene flow causing the isolated population to be more susceptible to disease, genetic abnormalities, and local extinction (Fahrig and Merriam 1985, Simberloff and Cox 1987, Beier 1993, Primack 1998). Roads act as barriers that isolate wetlands, which can cause a reduction in species richness of amphibians (Lehtinen et al. 1999). Roads also change the chemical conditions of wetlands and stream corridors from runoff of road salts, oil and other contaminants (Trombulak and Frissell 2000), which are also known to reduce amphibian populations (Lehtinen et al. 1999).

Existence of corridors. For habitat specialists or species with limited dispersal capabilities, the presence of corridors may provide an effective means to enhance dispersal, thus reducing the effects of isolation and fragmentation on a population (Simberloff and Cox 1987, Collinge 1996, Beier and Noss 1998, Haddad 1999). Habitat corridors are defined as “a linear landscape element that provides for movement between habitat patches” (Rosenberg and Noon 1997) and are predicted to be more beneficial to populations when connecting large patches of habitat (Haas 1995, Desrochers and Hannon 1997, Haddad 2000, Hudgens and Haddad 2003).

Larger mammals have been shown to include corridors in their home ranges (Simberloff and Cox 1987) and use them while dispersing (Beier 1995).

Furthermore, smaller-bodied species and species with high population growth rates that cannot survive outside the preferred habitat, such as some butterfly species, received greater benefits from habitat corridors than larger-bodied species (Fahrig and Merriam 1994, Bowne et al. 1998, Hudgens and Haddad 2003). Although the effectiveness of habitat corridors is disputed, particularly for birds (Simberloff and Cox 1987, Haddad 2000, Norris and Stutchbury 2001, Hudgens and Haddad 2003), studies have shown that corridors are more effective at greater widths (Collinge 1996, Haddad 1999, Haddad 2000). Many species of birds have a higher probability of using corridors as corridors get wider (Keller et al. 1993). Specifically, the probability of occurrence of prothonotary warblers, white-eyed vireos, eastern wood-pewees, red-eyed vireos, scarlet tanagers, kentucky warblers and louisiana waterthrushes all increased with corridor width. The probability of occurrence of acadian flycatchers and wood thrushes also increased with corridor width, but the maximum probability was at a width of only 300 meters for both species (Keller et al. 1993). From this kind of data, Hodges and Krementz (1996) and Keller et al. (1993) recommended that riparian corridors be a minimum of 100 meters wide to provide nesting habitat for area-sensitive species and Neotropical migrants, but priority should be made in preserving the widest corridors possible. Being that habitat corridors are intended to facilitate movement between habitat patches, we agree with Beier and Noss (1998) in their conclusion “that evidence from well-designed studies generally supports the utility of corridors as a conservation tool.”

Disturbance. Disturbance is defined as an event that significantly alters the structure or function of a system (Forman 1995). There are generally two types of disturbance: Natural and human. For example, a natural disturbance may be caused by floods, earthquakes, fires, etc., while human disturbances exist as roads, agriculture, silviculture, etc. (Forman 1995).

For bird communities, the type of disturbance can have more of an effect than the extent of disturbance (Rodewald and Yahner 2001). Older forests with larger, fewer trees (large basal areas) and well-developed canopy, subcanopy, shrub, and herbaceous layers with a well-developed component of

dead biomass (standing or fallen trees) support the highest diversity of species. Many silviculture practices favor monocultures and/or even-aged stands that are rarely left long enough to develop the necessary vegetative structure to support diverse faunal communities. Clear-cut forests tend to have the lowest species richness (Triquet et al. 1990). Higher numbers of species occur in uncut forests than in forests where best management practices with buffer strips are implemented.

Individual species have different levels of tolerance to different types of disturbance. For instance, blue-gray gnatcatchers, eastern towhees, ovenbirds, scarlet tanagers, and wood thrushes are intolerant to forest disturbance, while warbling vireos, yellow warblers, and field sparrows have a low tolerance to forest disturbance (Stauffer and Best 1980). Rodewald and Yahner (2001) found that agricultural disturbance within forested landscapes negatively affected bird communities in adjacent forests, and silvicultural practices, which produced even-aged forest stands, tended to increase the abundance of edge species and canopy nesters.

For species that require early-successional habitats (grassland and scrub-shrub bird communities), disturbance such as fire or mowing is necessary to maintain these habitats. Here again, vegetation structure is critical. Mechanized, row-crop agriculture does not produce suitable habitat for grassland species, and early mowing of non-row crops destroys nests, nestlings and adult birds. Conversion of farmland into development completely destroys habitat.

Roads have been used to define boundaries of habitat patches, particularly when bisecting a forest patch. Many small mammals and ground-dwelling invertebrates will perceive a roadway 20 meters wide or less as a barrier (Noss 1991). A road bisecting a forest would not affect the physical ability of birds to travel between patches (Hudgens and Haddad 2003), however, roads can impact species that prefer forest interiors and can cause high mortality of all species. Forman and Deblinger (2000) found the population of forest-interior species to be one-third its normal capacity within 650 meters of a four-lane highway. The noise generated from traffic along a major highway caused birds to avoid areas from 40 to 2,800 meters of the

road, depending on the amount of traffic (Reijnan et al. 1995).

As with forest-interior species, recent research has demonstrated that the presence of vehicular traffic can cause otherwise suitable early-successional habitat to become unsuitable. The presence of grassland birds breeding in an area of quality habitat (hayfield, lightly grazed pasture, old field) is affected by the size of the patch and the distance of the patch to a road with moderate or heavy traffic (>8,000 vehicles per day) (Reijnan et al. 1995, Forman et al.

2002). Fewer breeding birds were found in patches of quality grassland habitat within 400 meters of a road with moderate traffic (8,000-15,000 vehicles per day) to 1,200 meters of a road with heavy traffic (= 30,000 vehicles per day) (Reijnan et al. 1995, Forman et al. 2002). eastern meadowlarks, in particular, are less sensitive than other grassland species to traffic volume, being affected by roads with only heavy traffic (= 30,000 vehicles per day), but are more sensitive to the amount of development surrounding the habitat patch (Forman et al. 2002).

Table I. Priority Bird Species Based on Habitat Preference.

Common Name	Migratory Habit	Area Sensitive	Vulnerable to Fragmentation	Citation ID
Interior Forest				
Acadian Flycatcher	Neotropical	Yes	Yes	1
Baltimore Oriole	Neotropical	No	No	43
Black-and-white Warbler	Neotropical	Yes	Yes	8
Black-billed Cuckoo	Neotropical	Yes	Yes	6
Blackburnian Warbler	Neotropical	Yes	Yes	14
Black-throated Blue Warbler	Neotropical	Yes	Yes	15
Black-throated Green Warbler	Neotropical	Yes	Yes	5
Broad-winged Hawk	Neotropical	Yes	Yes	10
Canada Warbler	Neotropical	Yes	Yes	11
Carolina Chickadee	Resident	Yes	Yes	44
Cerulean Warbler	Neotropical	Yes	Yes	45
Eastern Wood-pewee	Neotropical	Yes	Yes	9
Gray Catbird	Short distance	Moderate	Moderate	44
Hairy Woodpecker	Resident	Yes	Yes	44
Hermit Thrush	Short distance	Unknown	Unknown	36
Hooded Warbler	Neotropical	Yes	Yes	7
Kentucky Warbler	Neotropical	Yes	Yes	28
Least Flycatcher	Neotropical	Yes	No	18
Louisiana Waterthrush	Neotropical	Yes	Yes	8
Northern Flicker	Resident	No	Moderate	37
Northern Parula	Neotropical	Yes	Yes	25
Northern Saw-whet Owl	Short distance	Yes	No	21
Pine Warbler	Neotropical	Yes	Yes	27
Prothonotary Warbler	Neotropical	Yes	Yes	46
Purple Finch	Short distance	No	Yes	48
Red Crossbill	Short distance	Unknown	Unknown	
Red-breasted Nuthatch	Short distance	Unknown	Unknown	36
Red-eyed Vireo	Neotropical	Yes	Yes	44
Rose-breasted Grosbeak	Neotropical	No	No	49
Scarlet Tanager	Neotropical	Yes	Yes	44
Sharp-shinned Hawk	Short distance	Yes	Unknown	16
Blue-headed Vireo	Neotropical	Yes	Yes	5
Veery	Neotropical	Yes	Yes	12
White-eyed Vireo	Short distance	Yes	Yes	40
Winter Wren	Short distance	Yes	Yes	5
Wood Thrush	Neotropical	Yes	Yes	26
Worm-eating Warbler	Neotropical	Yes	Yes	8
Yellow-billed Cuckoo	Neotropical	Yes	Yes	20
Yellow-throated Vireo	Neotropical	Yes	Yes	4

Table I. (Cont.) Priority Bird Species Based on Habitat Preference.

Common Name	Migratory Habit	Area Sensitive	Vulnerable to Fragmentation	Citation ID
<u>Grassland</u>				
American Kestrel	Short distance	Yes	No	31
Barn Owl	Short distance	No	No	35
Dickcissel	Neotropical	Yes	No	29
Eastern Bluebird	Short distance	No	No	3
Eastern Kingbird	Neotropical	No	No	38
Eastern Meadowlark	Short distance	Yes	No	34
Northern Bobwhite	Resident	Moderate	No	17
Horned Lark	Short distance	No	No	13
<u>Shrub-Scrub/Barrens</u>				
American Woodcock	Short distance	No	No	33
Blue-winged Warbler	Neotropical	Unknown	No	19
Brown Thrasher	Short distance	Unknown	Unknown	
Chuck-will's Widow	Neotropical	Yes	No	47
Common Nighthawk	Neotropical	No	No	42
Eastern Towhee	Short distance	Moderate	No	32
Field Sparrow	Short distance	Moderate	Moderate	22
Golden-winged Warbler	Neotropical	Unknown	No	24
Indigo Bunting	Neotropical	No	Moderate	41
Prairie Warbler	Neotropical	Yes	Yes	2
Whip-poor-will	Neotropical	Unknown	Moderate	23
Willow Flycatcher	Neotropical	Unknown	Yes	39
Yellow-breasted Chat	Neotropical	No	No	30

Table II. Literature Citations for Species in Table I.

<i>ID</i>	<i>Citation</i>
1	Askins & Philbrick 1987, Benzinger 1994, Darr et al. 1998, Rich et al. 1994, Robbins et al. 1989, Whitcomb et al. 1981
2	A. Dey unpubl. Data, McIntyre 1995, Staicer et al. 1995
3	Adair & Plissner 1998
4	Askins & Philbrick 1987, Rich et al. 1994, Zeller et al. 1993
5	Askins & Philbrick 1987, Benzinger 1994, Rich et al. 1994
6	Askins & Philbrick 1987, Darr et al. 1998, Deeble et al. 2000, Rich et al. 1994, Whitcomb et al. 1981
7	Askins & Philbrick 1987, Darr et al. 1998, Heckscher & Mehlman 1999, Rich et al. 1994, Whitcomb et al. 1981
8	Askins & Philbrick 1987, Darr et al. 1998, Rich et al. 1994, Robbins et al. 1989, Whitcomb et al. 1981
9	Askins & Philbrick 1987, Darr et al. 1998, Rich et al. 1994, Whitcomb et al. 1981
10	Askins & Philbrick 1987, Rich et al. 1994
11	Askins & Philbrick 1987, Rich et al. 1994, Robbins et al. 1989
12	Askins & Philbrick 1987, Rich et al. 1994, Robbins et al. 1989, Whitcomb et al. 1981
13	Beasen 1995, Dinkins et al. 2001
14	Benzinger 1994, Catlin et al. 1999
15	Benzinger 1994, Robbins et al. 1989
16	Bildstein & Meyer 2000
17	Brennan 1999
18	Briskie 1994, Villard et al. 1999
19	Brown et al. 1999
20	Brown et al. 1999, Darr et al. 1998, Robbins et al. 1989, Whitcomb et al. 1981
21	Cannings 1993
22	Carey et al. 1993, Dechant et al. 2001
23	Cink 2002
24	Confer et al. 1992
25	Darr et al. 1998, Hammerson et al. 2001, Robbins et al. 1989, Whitcomb et al. 1981
26	Darr et al. 1998, Hoover et al. 1995, Robbins et al. 1989, Whitcomb et al. 1981
27	Darr et al. 1998, Rodewald et al. 1995, Whitcomb et al. 1981
28	Darr et al. 1998, Robbins et al. 1989, Whitcomb et al. 1981
29	Dechant et al. 2001
30	Eckerle & Thompson 2001, Thompson et al. 1996
31	Forman et al. 1976
32	Greenlaw 1996
33	Keppie & Whiting 1994
34	Lanyon 1995, Forman et al. 2002
35	Marti 1992, Rosenburg et al. 1998
36	McIntyre 1995
37	Moore 1995
38	Murphy 1996
39	Paige et al. 1998
40	Palis et al. 2001
41	Payne 1992
42	Poulin et al. 1996
43	Rising & Flood 1998
44	Robbins et al. 1989
45	Robbins et al. 1989, Whitcomb et al. 1981
46	Sallabanks et al. 1993, Whitcomb et al. 1981
47	Straight & Cooper 2000
48	Woottan 1996
49	Wyatt & Francis 2002

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Appendix II. Additional Methods for Extracting Critical Wildlife Areas from Urban Land-use/Land-cover Classes

LU/LC class 1400

1400 TRANSPORTATION, COMMUNICATION & UTILITIES

The transportation, communication, and utilities land uses are often associated with the other Urban or Built-up categories, but are often found in other categories. However, they often do not meet the minimum size required for mapping and are considered an integral part of the land use in which they occur. The presence of major transportation routes, utilities such as sewage treatment plants and power lines, and communications facilities greatly influence both the present and potential uses of an area. These areas generally have a high percentage of impervious surface coverage.

- Select the polygons from the “1400 TRANSPORTATION / COMMUNICATIONS / UTILITIES,” as coded in the NJDEP Land Use/Land Cover, that have less than or equal to 5% impervious surface.
- From this subset intersect the grassland species models. Where there is overlap, recode these polygons as “Grassland.” All other polygons from the subset will be recoded as “Forest.”
- Merge the recoded polygons into the existing “Grassland” and “Forest” layers respectively.
- Dissolve the resultant “Grassland” and “Forest” layers.
- Assign a unique Link ID to each of the independent “Grassland” and “Forest” polygons (patches).

LU/LC class 1700

1700 OTHER URBAN OR BUILT-UP

Included are undeveloped, open lands within urban areas. Some structures may be visible, as in the case of abandoned residential or commercial sites that have not yet been redeveloped. Other areas may be brush-covered or grassy. Large, managed, maintained lawns common to some residential areas, and those open areas of commercial/service complexes, educational installations, etc., are also included. Undeveloped, but maintained lawns in urban parks are also part of this category, if a specific recreational use is not evident. In addition, areas that have been partially developed or redeveloped but remain unfinished are included. Also included in this category are cemeteries.

- Select the polygons from the “1700 OTHER URBAN OR BUILT UPLANDS,” as coded in the NJDEP Land Use/Land Cover, that have less than or equal to 10% impervious surface.
- From this subset, select the polygons within 0.8 kilometers of an airport, using an airport shapefile from the 2002 National Transportation Atlas.
- Create a new grassland/airport shapefile using the selected polygons.
- From grassland/airport shapefile, recode all of the polygons in the lower 10 kilometers of Cape May as “Grassland.”
- For all areas outside of the lower 10 kilometers, select the polygons that meet the minimum size requirement for grasslands (18 hectares). Add to that selected set, the polygons that intersect a grassland species model.
- Recode the selected polygons as “Grassland.”
- Merge all of the recoded polygons into the existing “Grassland” layer.
- Dissolve the resultant “Grassland” layer.
- Assign a unique Link ID to each of the independent “Grassland” polygons (patches).

Appendix III. Protocol for Accepting or Rejecting Species Sighting Reports

1. When a sighting report arrives at the ENSP office it is logged in and tracked in a database, regardless of acceptability.
2. If no additional information is needed, the sighting report is sent to the appropriate ENSP biologist for review.
3. If additional information is needed, an attempt is made to obtain the required information. This can include sending a map to the observer to mark the location of the sighting, a telephone interview to clarify information, etc. After all of the required information is obtained the report is sent to the appropriate ENSP biologist for review.
4. ENSP biologist receives the sighting report and reviews it for acceptability/reliability. A species sighting is accepted or rejected based on the following criteria:
 - ◆ Did the sighting occur within the known range of the species?
 - ◆ Did the sighting occur in the known/recognized habitat for the species?
 - ◆ Is the species easily identified, or is it often confused with another?
 - ◆ Did anyone else confirm the sighting, or can someone else vouch for the observer's identification skills?
 - ◆ Do we have first-hand knowledge of the observer's identification skills?
 - ◆ Did the observer include a photograph?
 - ◆ Is the species listed as endangered or threatened for the season in which it was reported? (Some species can have a separate status for breeding season and non breeding season.)
 - ◆ If uncertainty remains about the validity of the sighting, the observer is interviewed by the ENSP biologist.
 - a. If sufficient information accompanies the sighting report the record is either accepted or rejected by an ENSP biologist. The report is then returned to ENSP's GIS staff and advances to step 5 if accepted.
 - b. The reviewing biologist may determine that it is necessary to gather additional information (e.g., ascertain observer experience, ask if there have been additional sightings, ask for photos, ask for verifications by second observer, etc.) before the record can be accepted. If the record is accepted, advance to step 5.
 - c. If the reviewing biologist determines that the sighting must be field checked, it is initially rejected until fieldwork can be scheduled to verify the sighting.
5. ENSP GIS staff digitizes the sighting location and prepares the data in a standardized format to submit to the Natural Heritage Program (NHP).
6. NHP quality checks the documents submitted and enters the data into the Biological Conservation Database (BCD).

Appendix IV. Species Models

Common Name	Landscape Model
Birds	
Federal T or E	
BALD EAGLE FORAGING AREA*	Foraging Model
BALD EAGLE NEST BUFFER	1 km buffer
BALD EAGLE WINTERING SITE	Not used
PIPING PLOVER	Digitized by ENSP staff
ROSEATE TERN	BCD model
State Endangered	
AMERICAN BITTERN	BCD model
BLACK SKIMMER	BCD model/digitized by ENSP Staff
BLACK SKIMMER FORAGING AREA ¹	Based on ENSP digitized polygons
HENSLOW'S SPARROW	BCD model
LEAST TERN ¹	BCD model/digitized by ENSP Staff
LEAST TERN FORAGING HABITAT ¹	Based on ENSP digitized polygons
MIGRANT LOGGERHEAD SHRIKE	BCD model
MIGRATORY RAPTOR CONCENTRATION SITE ²	BCD model
MIGRATORY SHOREBIRD CONCENTRATION SITE ³	BCD model
NORTHERN GOSHAWK	BCD model, 300 m buffer
NORTHERN HARRIER	BCD model
PEREGRINE FALCON*	1 km buffer
PIED-BILLED GREBE	BCD model
RED-SHOULDERED HAWK ⁴	BCD model/1.609 km buffer
SEDGE WREN	BCD model
SHORT-EARED OWL	BCD model
UPLAND SANDPIPER	BCD model
VESPER SPARROW	BCD model
State Threatened	
BARRED OWL ⁴	BCD model/1.609 km buffer
BLACK RAIL	BCD model
BLACK-CROWNED NIGHT-HERON	BCD model/digitized by ENSP Staff
BLACK-CROWNED NIGHT-HERON FORAGING HABITAT ¹	Based on ENSP digitized polygons
BLACK-CROWNED NIGHT-HERON NESTING HABITAT ¹	Based on ENSP digitized polygons
BOBOLINK	BCD model
COOPER'S HAWK	BCD model, 300 m buffer
GRASSHOPPER SPARROW	BCD model
LONG-EARED OWL	BCD model
OSPREY	BCD model, 300 m buffer
RED KNOT	BCD model
RED-HEADED WOODPECKER	BCD model
SAVANNAH SPARROW	BCD model
YELLOW-CROWNED NIGHT-HERON	BCD model/digitized by ENSP Staff
YELLOW-CROWNED NIGHT-HERON FORAGING HABITAT ¹	Based on ENSP digitized polygons
YELLOW-CROWNED NIGHT-HERON NESTING HABITAT ¹	Based on ENSP digitized polygons

Appendix IV. (Cont.)

Common Name	Landscape Model
<u>Priority Species</u>	
BIRD SPECIES OF PRIORITY	BCD model
COLONIAL WATERBIRD FORAGING HABITAT ¹	Based on ENSP digitized polygons
COLONIAL WATERBIRD NESTING HABITAT ¹	Based on ENSP digitized polygons
<u>Herptiles</u>	
<u>Federal T or E</u>	
ATLANTIC GREEN TURTLE	Not used
ATLANTIC HAWKBILL	Not used
ATLANTIC LEATHERBACK	Not used
ATLANTIC LOGGERHEAD	Not used
ATLANTIC RIDLEY	Not used
BOG TURTLE ⁵	DEP FWW selected that represent habitat
<u>State Endangered</u>	
BLUE-SPOTTED SALAMANDER	300 m buffer
COPE'S GRAY TREEFROG	300 m buffer
CORN SNAKE	BCD model
EASTERN TIGER SALAMANDER	300 m buffer
TIMBER RATTLESNAKE ⁶	BCD/southern forested wetland model
<u>State Threatened</u>	
EASTERN MUD SALAMANDER	BCD model
LONGTAIL SALAMANDER	300 m buffer
NORTHERN PINE SNAKE	500 m buffer
PINE BARRENS TREEFROG	300 m buffer
WOOD TURTLE*	Wood turtle model
<u>Priority Species</u>	
HERPTILE SPECIES OF PRIORITY	1/6 USGS Quadrangle
<u>Invertebrates</u>	
<u>Federal T or E</u>	
AMERICAN BURYING BEETLE	BCD model
DWARF WEDGEMUSSEL	Not used
MITCHELL'S SATYR	BCD model
NORTHEASTERN BEACH TIGER BEETLE	BCD model
<u>State Endangered</u>	
APPALACHIAN GRIZZLED SKIPPER	BCD model
AROGOS SKIPPER	BCD model
BRONZE COPPER	BCD model
BROOK FLOATER	Not used
GREEN FLOATER	Not used
<u>State Threatened</u>	
CHECKERED WHITE	BCD model
EASTERN LAMPMUSSEL	Not used
EASTERN POND MUSSEL	Not used

Appendix IV. (Cont.)

Common Name	Landscape Model
<u>State Threatened</u>	
FROSTED ELFIN	BCD model
SILVER-BORDERED FRITILLARY	BCD model
TIDEWATER MUCKET	BCD model
TRIANGLE FLOATER	Not used
YELLOW LAMPMUSSEL	Not used
<u>Priority Species</u>	
INVERTEBRATE SPECIES OF PRIORITY	BCD model
<u>Mammals</u>	
<u>Federal T or E</u>	
BLACK RIGHT WHALE	Not used
BLUE WHALE	Not used
FIN WHALE	Not used
HUMPBACK WHALE	Not used
INDIANA BAT	2 km buffer
SEI WHALE	Not used
SPERM WHALE	Not used
<u>State Endangered</u>	
ALLEGHENY WOODRAT	BCD model
BOBCAT ⁴	BCD model

**For explanation of model see "Detailed Methodology for Delineating Critical Areas by Special Habitat Requirements."*

1. Colonial Nesting Waterbirds

Terns and Skimmers: Nesting area critical habitat includes all open water, beaches, mudflats and emergent wetlands within the foraging radius from a known nesting colony.

Foraging radii:

black skimmer	10.46 kilometers	forsters tern	12.07 kilometers
least tern	4.82 kilometers	common tern	12.07 kilometers

Herons and Egrets: Critical nesting habitat includes all undeveloped habitat within 90 meters (3 pixels) of a known nesting colony, 180 meters for great blue heron. Critical foraging habitat includes all emergent wetlands, all tidal creeks and ditches, and all open waters within 90 meters of the shoreline within the foraging radius of a known nesting colony.

Foraging radii:

great egret	11.42 kilometers	tricolored heron	10.46 kilometers
snowy egret	13.84 kilometers	black-crowned night heron	9.65 kilometers
cattle egret	11.26 kilometers	yellow-crowned night heron	2.73 kilometers
great blue heron	12.07 kilometers	glossy ibis	14.64 kilometers
little blue hereon	13.19 kilometers		

2. Migratory Raptor Concentration Site: All non developed habitat (1995 CRSSA LC) in the lower 10 kilometers of the Cape May peninsula.
CWCS pages 579 - 637

3. Migratory Shorebird Concentration Site: ENSP staff hand-digitized polygons that represent sites where migratory shorebirds congregate for feeding or staging during migration.

4. Barred Owl, Red-shouldered Hawk and Bobcat: Since these species require large, unfragmented patches of forest they only value those patches that meet the core area requirements as defined in the “Detailed Methodology for Delineating Critical Areas by Habitat Type” section of this document.

5. Bog Turtle: Critical areas for bog turtles are mapped by hand-selecting emergent, scrub/shrub, modified agricultural and forested wetland polygons from the DEP Freshwater Wetlands maps. The selected wetland habitats correspond to core bog turtle habitat (i.e. where turtles are concentrated), contiguous dispersal corridors between extant colonies within 1.6 kilometers of each other, and groundwater discharge areas, where possible. Only extant populations were mapped. Suitable bog turtle habitat that is not connected to an extant site is not incorporated into the mapping.

6. Timber Rattlesnake

Skylands Landscape: Hand-digitized polygons that represent timber rattlesnake den locations and their associated foraging areas. This is adequate in protecting the majority of female gestating and birthing areas, transient habitat and foraging habitat. Most gestating and birthing areas in this part of the state occur within a few to several hundred meters of the den location.

Pinelands and Delaware Bay Landscapes: Any portion of a stream (including intermittent) within 2.5 kilometers of a timber rattlesnake occurrence (seconds precision only) is considered “potential hibernacula.” The identified stream segments are buffered 1 kilometer.

Appendix V. NJDEP 1995/97 Land-use/Land-cover Classes and Corresponding Landscape Habitats

Level 1 Class	Level 3 Modified Class	Habitat
BARREN LAND	BEACHES	Beach
WETLANDS	AGRICULTURAL WETLANDS (MODIFIED)	Emergent Wetland
WETLANDS	FORMER AGRICULTURAL WETLAND (BECOMING SHRUBBY)	Emergent Wetland
WETLANDS	FRESHWATER TIDAL MARSHES	Emergent Wetland
WETLANDS	HERBACEOUS WETLANDS	Emergent Wetland
WETLANDS	SALINE MARSHES	Emergent Wetland
WETLANDS	SEVERE BURNED WETLANDS	Emergent Wetland
WETLANDS	VEGETATED DUNE COMMUNITIES	Emergent Wetland
WETLANDS	WETLAND RIGHTS-OF-WAY (MODIFIED)	Emergent Wetland
FOREST	CONIFEROUS BRUSH/SHRUBLAND	Forest
FOREST	CONIFEROUS FOREST (>50% CROWN CLOSURE)	Forest
FOREST	CONIFEROUS FOREST (10-50% CROWN CLOSURE)	Forest
FOREST	DECIDUOUS BRUSH/SHRUBLAND	Forest
FOREST	DECIDUOUS FOREST (>50% CROWN CLOSURE)	Forest
FOREST	DECIDUOUS FOREST (10-50% CROWN CLOSURE)	Forest
FOREST	MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND	Forest
FOREST	MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)	Forest
FOREST	MIXED FOREST (>50% CONIFEROUS WITH 10%-50% CROWN CLOSURE)	Forest
FOREST	MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)	Forest
FOREST	MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)	Forest
FOREST	OLD FIELD (< 25% BRUSH COVERED)	Forest
FOREST	PLANTATION	Forest
FOREST	SEVERE BURNED UPLAND VEGETATION	Forest
AGRICULTURE	CONFINED FEEDING OPERATIONS	Grassland
AGRICULTURE	CROPLAND AND PASTURELAND	Grassland
AGRICULTURE	ORCHARDS/VINEYARDS/NURSERIES/ HORTICULTURAL AREAS	Grassland
AGRICULTURE	OTHER AGRICULTURE	Grassland
URBAN*	OTHER URBAN OR BUILT-UP LAND	Grassland
URBAN*	TRANSPORTATION/COMMUNICATIONS/UTILITIES	Grassland/Forest
WETLANDS	ATLANTIC WHITE CEDAR SWAMP	Forested Wetland/Forest
WETLANDS	CONIFEROUS SCRUB/SHRUB WETLANDS	Forested Wetland/Forest
WETLANDS	CONIFEROUS WOODED WETLANDS	Forested Wetland/Forest
WETLANDS	DECIDUOUS SCRUB/SHRUB WETLANDS	Forested Wetland/Forest
WETLANDS	DECIDUOUS WOODED WETLANDS	Forested Wetland/Forest
WETLANDS	MIXED FORESTED WETLANDS (CONIFEROUS DOM.)	Forested Wetland/Forest
WETLANDS	MIXED FORESTED WETLANDS (DECIDUOUS DOM.)	Forested Wetland/Forest
WETLANDS	MIXED SCRUB/SHRUB WETLANDS (CONIFEROUS DOM.)	Forested Wetland/Forest
WETLANDS	MIXED SCRUB/SHRUB WETLANDS (DECIDUOUS DOM.)	Forested Wetland/Forest

*A method using impervious service and species models was developed to select out rights-of-way that contained critical areas from this classification (**Appendix II**).

Appendix VI. Species and the Habitat Types they Value

Common Name	Emergent Wetland	Forested Wetland	Forest	Grassland	Beach
Birds					
Federal T or E					
BALD EAGLE FORAGING AREA					
BALD EAGLE NEST BUFFER	X	X	X	X	
PIPING PLOVER					X
ROSEATE TERN	X				X
State Endangered					
AMERICAN BITTERN	X				
BLACK SKIMMER	X				X
BLACK SKIMMER FORAGING AREA	X				
HENSLOW'S SPARROW	X			X	
LEAST TERN	X				X
LEAST TERN FORAGING HABITAT	X				
MIGRANT LOGGERHEAD SHRIKE				X	
MIGRATORY RAPTOR CONCENTRATION SITE	X	X	X	X	
MIGRATORY SHOREBIRD CONCENTRATION SITE					X
NORTHERN GOSHAWK		X	X		
NORTHERN HARRIER	X			X	
PEREGRINE FALCON	X				
PIED-BILLED GREBE	X				
RED-SHOULDERED HAWK		X	X*		
SEDGE WREN	X			X	
SHORT-EARED OWL	X			X	
UPLAND SANDPIPER				X	
VESPER SPARROW				X	
State Threatened					
BARRED OWL		X	X*		
BLACK RAIL	X				
BLACK-CROWNED NIGHT-HERON	X				
BLACK-CROWNED NIGHT-HERON FORAGING HABITAT	X				
BLACK-CROWNED NIGHT-HERON NESTING HABITAT	X		X		
BOBOLINK				X	
COOPER'S HAWK		X	X		
GRASSHOPPER SPARROW				X	
LONG-EARED OWL			X	X	
OSPREY	X				X
RED KNOT	X				X
RED-HEADED WOODPECKER			X		
SAVANNAH SPARROW				X	
YELLOW-CROWNED NIGHT-HERON	X				
YELLOW-CROWNED NIGHT-HERON FORAGING HABITAT	X				

Appendix VI. (Cont.)

Common Name	Emergent Wetland	Forested Wetland	Forest	Grassland	Beach
State Threatened					
YELLOW-CROWNED NIGHT-HERON NESTING HABITAT	X		X		
Priority Species					
ACADIAN FLYCATCHER		X	X		
AMERICAN BLACK DUCK	X	X			
AMERICAN KESTREL				X	
AMERICAN OYSTERCATCHER	X				X
AMERICAN WOODCOCK		X	X		
ARCTIC TERN	X				X
BALTIMORE ORIOLE			X		
BARN OWL				X	
BLACK TERN					X
BLACK-AND-WHITE WARBLER		X	X		
BLACK-BILLED CUCKOO		X	X		
BLACKBURNIAN WARBLER		X	X		
BLACK-THROATED BLUE WARBLER		X	X		
BLACK-THROATED GREEN WARBLER		X	X		
BLUE-WINGED WARBLER	X	X	X		
BROAD-WINGED HAWK			X		
BROWN CREEPER		X	X		
BROWN THRASHER		X	X		
CANADA WARBLER		X	X		
CAROLINA CHICKADEE		X	X		
CASPIAN TERN	X				X
CATTLE EGRET	X				
CERULEAN WARBLER		X	X		
CHIMNEY SWIFT					
CHUCK-WILL'S-WIDOW		X	X		
CLAPPER RAIL	X				
CLIFF SWALLOW	X			X	
COLONIAL WATERBIRD FORAGING HABITAT	X				
COLONIAL WATERBIRD NESTING HABITAT	X		X		
COMMON MOORHEN	X				
COMMON NIGHTHAWK			X	X	X
COMMON TERN	X				X
DICKCISSEL				X	
EASTERN BLUEBIRD				X	
EASTERN KINGBIRD				X	
EASTERN MEADOWLARK				X	
EASTERN TOWHEE		X	X		
EASTERN WOOD-PEWEE			X		
FIELD SPARROW				X	
FORSTER'S TERN	X				X
GLOSSY IBIS	X				
GOLDEN-WINGED WARBLER			X		
GRAY CATBIRD		X	X		
GRAY-CHEEKED THRUSH		X	X		

Appendix VI. (Cont.)

Common Name	Emergent Wetland	Forested Wetland	Forest	Grassland	Beach
Priority Species					
GREAT BLUE HERON	X	X	X		
GREAT EGRET	X				
GULL-BILLED TERN	X				X
HAIRY WOODPECKER		X	X		
HERMIT THRUSH		X	X		
HOODED WARBLER		X	X		
HORNED LARK				X	X
IPSWICH SPARROW				X	X
KENTUCKY WARBLER		X	X		
KING RAIL	X				
LEAST BITTERN	X				
LEAST FLYCATCHER		X	X		
LITTLE BLUE HERON	X				
LOUISIANA WATERTHRUSH		X	X		
MARSH WREN	X				
NORTHERN BOBWHITE				X	
NORTHERN PARULA		X	X		
NORTHERN SAW-WHET OWL			X		
PINE WARBLER		X	X		
PRAIRIE WARBLER		X	X		
PROTHONOTARY WARBLER		X	X		
PURPLE FINCH		X	X		
RED CROSSBILL		X	X		
RED-BREASTED NUTHATCH		X	X		
RED-EYED VIREO		X	X		
ROSE-BREASTED GROSBEAK		X	X		
SALTMARSH SHARP-TAILED SPARROW	X				
SANDERLING					X
SCARLET TANAGER		X	X		
SEASIDE SPARROW	X				
SHARP-SHINNED HAWK		X	X		
SNOWY EGRET	X				
SOLITARY VIREO (BLUE-HEADED VIREO)		X	X		
SPOTTED SANDPIPER	X				
TERN SPECIES FORAGING HABITAT	X				
TRICOLORED HERON	X				
VEERY		X	X		
VIRGINIA RAIL	X				
WHIMBREL	X				
WHIP-POOR-WILL		X	X		
WHITE-EYED VIREO		X	X		
WILLET	X				X
WILLOW FLYCATCHER		X	X		
WINTER WREN		X	X		
WOOD THRUSH		X	X		
WORM-EATING WARBLER		X	X		
YELLOW-BILLED CUCKOO		X	X		
YELLOW-BREASTED CHAT		X	X		
YELLOW-THROATED VIREO		X	X		

Appendix VI. (Cont.)

Common Name	Emergent Wetland	Forested Wetland	Forest	Grassland	Beach
Herptiles					
Federal T or E					
BOG TURTLE	X	X			
State Endangered					
BLUE-SPOTTED SALAMANDER	X	X	X		
COPE'S GRAY TREEFROG	X	X	X		
CORN SNAKE			X		
EASTERN TIGER SALAMANDER	X	X	X		
TIMBER RATTLESNAKE		X	X		
State Threatened					
EASTERN MUD SALAMANDER		X	X		
LONGTAIL SALAMANDER	X	X	X		
NORTHERN PINE SNAKE			X	X	
PINE BARRENS TREEFROG	X	X	X		
WOOD TURTLE					
Priority Species					
CARPENTER FROG	X	X			
COASTAL PLAIN MILK SNAKE			X	X	
EASTERN BOX TURTLE			X	X	
EASTERN KINGSNAKE		X	X		
FOWLER'S TOAD	X	X			
JEFFERSON SALAMANDER		X	X		
MARBLED SALAMANDER	X	X	X		
NORTHERN COPPERHEAD			X		
NORTHERN DIAMONDBACK TERRAPIN	X				
NORTHERN SPRING SALAMANDER		X	X		
SPOTTED TURTLE	X	X			
Invertebrates					
Federal Tor E					
AMERICAN BURYING BEETLE					X
MITCHELL'S SATYR	X	X	X	X	
NORTHEASTERN BEACH TIGER BEETLE					X
State Endangered					
APPALACHIAN GRIZZLED SKIPPER	X	X	X	X	
AROGOS SKIPPER	X	X	X	X	
BRONZE COPPER	X	X	X	X	
State Threatened					
SILVER-BORDERED FRITILLARY	X	X	X	X	
CHECKERED WHITE	X	X	X	X	
FROSTED ELFIN	X	X	X	X	

Appendix VI. (Cont.)

Common Name	Emergent Wetland	Forested Wetland	Forest	Grassland	Beach
<u>Priority Species</u>					
DOTTED SKIPPER	X	X	X	X	
GEORGIA SATYR	X	X	X	X	
HARISS CHECKERSPOT	X	X	X	X	
HESEL'S HAIRSTREAK	X	X	X	X	
HOARY ELFIN	X	X	X	X	
NORTHERN METALMARK	X	X	X	X	
TWO-SPOTTED SKIPPER	X	X	X	X	
<u>Mammals</u>					
<u>Federal T or E</u>					
INDIANA BAT		X	X		
<u>State Endangered</u>					
ALLEGHENY WOODRAT			X		
BOBCAT	X	X	X*		

**Only values forest patches that meet the minimum core requirements.*

Appendix VII. Species and the Landscape Regions in which they Occur*

Common Name	Delaware Bay	Coastal	Piedmont Plains	Pinelands	Skylands
Birds					
Federal T or E					
BALD EAGLE FORAGING AREA	X	X	X	X	X
BALD EAGLE NEST BUFFER	X	X	X	X	X
PIPING PLOVER	X	X	X		
ROSEATE TERN		X			
State Endangered					
AMERICAN BITTERN			X	X	X
BLACK SKIMMER		X			
BLACK SKIMMER FORAGING AREA	X	X		X	
HENSLOW'S SPARROW	X	X	X		X
LEAST TERN	X	X	X	X	
LEAST TERN FORAGING HABITAT	X	X		X	
MIGRANT LOGGERHEAD SHRIKE	X	X	X		X
MIGRATORY RAPTOR CONCENTRATION SITE	X	X			
MIGRATORY SHOREBIRD CONCENTRATION SITE	X	X	X		
NORTHERN GOSHAWK				X	X
NORTHERN HARRIER	X	X	X	X	X
PEREGRINE FALCON	X	X	X	X	
PIED-BILLED GREBE	X	X	X	X	X
RED-SHOULDERED HAWK	X		X	X	X
SEDGE WREN	X		X		X
SHORT-EARED OWL	X	X			
UPLAND SANDPIPER			X	X	X
VESPER SPARROW	X		X	X	X
State Threatened					
BARRED OWL	X	X	X	X	X
BLACK RAIL	X	X			X
BLACK-CROWNED NIGHT-HERON	X	X	X	X	X
BLACK-CROWNED NIGHT-HERON FORAGING HABITAT	X	X	X	X	
BLACK-CROWNED NIGHT-HERON NESTING HABITAT		X	X		X
BOBOLINK	X		X	X	X
COOPER'S HAWK	X	X	X	X	X
GRASSHOPPER SPARROW	X		X	X	X
LONG-EARED OWL	X		X		X
OSPREY	X	X	X	X	X
RED KNOT	X	X			
RED-HEADED WOODPECKER	X		X	X	X
SAVANNAH SPARROW	X		X	X	X
YELLOW-CROWNED NIGHT-HERON		X	X	X	
YELLOW-CROWNED NIGHT-HERON FORAGING HABITAT	X	X	X	X	
YELLOW-CROWNED NIGHT-HERON NESTING HABITAT		X	X		

*Based on known species' ranges within the state.

Appendix VII. (Cont.)

Common Name	Delaware Bay	Coastal	Piedmont Plains	Pinelands	Skylands
Priority Species					
ACADIAN FLYCATCHER	X		X	X	X
AMERICAN BLACK DUCK	X	X	X	X	X
AMERICAN KESTREL	X		X		X
AMERICAN OYSTERCATCHER	X	X			
AMERICAN WOODCOCK	X	X	X	X	X
ARCTIC TERN		X			
BALTIMORE ORIOLE	X		X	X	X
BARN OWL	X	X	X		
BLACK TERN		X			
BLACK-AND-WHITE WARBLER	X		X	X	X
BLACK-BILLED CUCKOO	X		X	X	X
BLACKBURNIAN WARBLER					X
BLACK-THROATED BLUE WARBLER			X		X
BLACK-THROATED GREEN WARBLER			X	X	X
BLUE-WINGED WARBLER	X		X	X	X
BROAD-WINGED HAWK	X		X	X	X
BROWN CREEPER	X		X	X	X
BROWN THRASHER	X	X	X	X	X
CANADA WARBLER			X	X	X
CAROLINA CHICKADEE	X	X	X	X	
CASPIAN TERN		X			
CATTLE EGRET	X	X			X
CERULEAN WARBLER	X			X	X
CHIMNEY SWIFT	X	X	X	X	X
CHUCK-WILL'S-WIDOW	X			X	
CLAPPER RAIL	X	X			
CLIFF SWALLOW			X		X
COLONIAL WATERBIRD FORAGING HABITAT	X	X	X	X	
COLONIAL WATERBIRD NESTING HABITAT		X			
COMMON MOORHEN	X		X		X
COMMON NIGHTHAWK			X	X	X
COMMON TERN	X				X
DICKCISSEL			X		
EASTERN BLUEBIRD	X		X	X	X
EASTERN KINGBIRD	X	X	X	X	X
EASTERN MEADOWLARK	X		X	X	X
EASTERN TOWHEE	X	X	X	X	X
EASTERN WOOD-PEWEE	X		X	X	X
FIELD SPARROW	X		X	X	X
FORSTER'S TERN	X	X			
GLOSSY IBIS	X	X	X		
GOLDEN-WINGED WARBLER					X
GRAY CATBIRD	X	X	X	X	X
GRAY-CHEEKED THRUSH	X			X	X
GREAT BLUE HERON	X	X	X	X	X
GREAT EGRET	X	X	X		
GULL-BILLED TERN		X			
HAIRY WOODPECKER	X	X	X	X	X

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Appendix VII. (Cont.)

Common Name	Delaware Bay	Coastal	Piedmont Plains	Pinelands	Skylands
Priority Species					
HERMIT THRUSH			X	X	X
HOODED WARBLER	X		X	X	X
HORNED LARK			X	X	X
KENTUCKY WARBLER	X		X	X	X
KING RAIL	X				
LEAST BITTERN	X		X	X	X
LEAST FLYCATCHER			X	X	X
LITTLE BLUE HERON	X	X	X	X	
LOUISIANA WATERTHRUSH	X		X		X
MARSH WREN	X	X	X	X	X
NORTHERN BOBWHITE	X	X	X	X	X
NORTHERN PARULA	X		X	X	X
NORTHERN SAW-WHET OWL			X	X	X
PINE WARBLER	X	X	X	X	X
PRAIRIE WARBLER	X		X	X	X
PROTHONOTARY WARBLER	X		X	X	
PURPLE FINCH			X		X
RED CROSSBILL				X	
RED-BREASTED NUTHATCH	X		X	X	X
RED-EYED VIREO	X	X	X	X	X
ROSE-BREASTED GROSBEAK	X		X	X	X
SALTMARSH SHARP-TAILED SPARROW	X	X			
SANDERLING	X	X			
SCARLET TANAGER	X		X	X	X
SEASIDE SPARROW	X	X			
SHARP-SHINNED HAWK	X	X	X	X	X
SNOWY EGRET	X	X	X	X	
BLUE-HEADED VIREO					X
SPOTTED SANDPIPER	X		X	X	X
TERN SPECIES FORAGING HABITAT	X	X	X	X	
TRICOLORED HERON	X	X			
VEERY		X	X	X	X
VIRGINIA RAIL	X	X	X	X	X
WHIMBREL	X	X			
WHIP-POOR-WILL	X		X	X	X
WHITE-EYED VIREO	X		X	X	X
WILLET	X	X			
WILLOW FLYCATCHER	X		X	X	X
WINTER WREN					X
WOOD THRUSH	X	X	X	X	X
WORM-EATING WARBLER	X		X	X	X
YELLOW-BILLED CUCKOO	X	X	X	X	X
YELLOW-BREASTED CHAT	X		X	X	X
YELLOW-THROATED VIREO	X		X	X	X
Herptiles					
Federal T or E					
BOG TURTLE		X	X	X	X

Appendix VII. (Cont.)

Common Name	Delaware Bay	Coastal	Piedmont Plains	Pinelands	Skylands
State Endangered					
BLUE-SPOTTED SALAMANDER			X		X
COPE'S GRAY TREEFROG	X			X	
CORN SNAKE	X			X	
EASTERN TIGER SALAMANDER	X	X	X	X	
TIMBER RATTLESNAKE	X			X	X
State Threatened					
EASTERN MUD SALAMANDER			X		
LONGTAIL SALAMANDER			X		X
NORTHERN PINE SNAKE	X		X	X	
PINE BARRENS TREEFROG	X		X	X	
WOOD TURTLE			X	X	X
Priority Species					
CARPENTER FROG	X	X	X	X	X
COASTAL PLAIN MILK SNAKE			X	X	
EASTERN BOX TURTLE	X	X	X	X	X
EASTERN KINGSNAKE	X	X	X	X	
FOWLER'S TOAD	X	X	X	X	X
JEFFERSON SALAMANDER			X		X
MARbled SALAMANDER	X	X		X	X
NORTHERN COPPERHEAD			X		X
NORTHERN DIAMONDBACK TERRAPIN	X	X	X	X	X
NORTHERN SPRING SALAMANDER			X	X	X
SPOTTED TURTLE	X	X	X	X	X
Invertebrates					
Federal Tor E					
AMERICAN BURYING BEETLE			X		X
MITCHELL'S SATYR					X
NORTHEASTERN BEACH TIGER BEETLE		X			
State Endangered					
APPALACHIAN GRIZZLED SKIPPER					X
AROGOS SKIPPER				X	X
BRONZE COPPER	X		X		
State Threatened					
SILVER-BORDERED FRITILLARY	X			X	X
CHECKERED WHITE			X		
FROSTED ELFIN	X		X	X	
Priority Species					
DOTTED SKIPPER	X		X	X	
GEORGIA SATYR				X	
HARISS CHECKERSPOT			X		X
HESEL'S HAIRSTREAK	X			X	

Appendix VII. (Cont.)

Common Name	Delaware Bay	Coastal	Piedmont Plains	Pinelands	Skylands
<u>Priority Species</u>					
HOARY ELFIN				X	
NORTHERN METALMARK					X
TWO-SPOTTED SKIPPER			X	X	
<u>Mammals</u>					
<u>Federal T or E</u>					
INDIANA BAT					X
<u>State Endangered</u>					
ALLEGHENY WOODRAT			X		X
BOBCAT	X		X	X	X

Appendix III. Literature Review

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